POPULAR AVIATION

Combined with Practical Mechanics; Including Aeronautics and Aviation Stories and Mechanics

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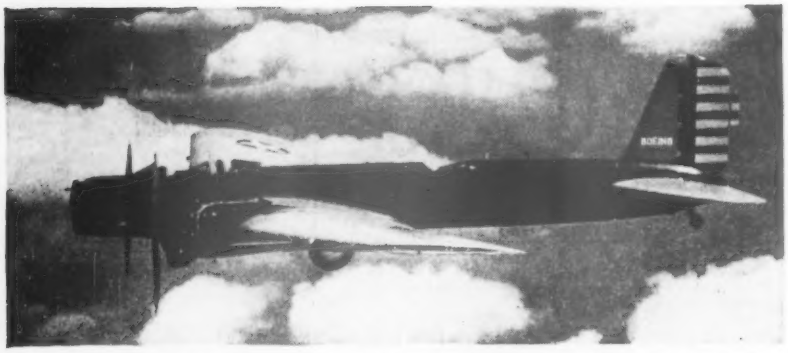
Flight Testing



The Boeing bomber in flight, a new type that has been exhaustively tested by Captain Gothlin.

by
HARLOWE
STENGEL

THE pursuit ship roared down from the sky in a power dive. It hurtled through the last bank of clouds, turned upward and with terrific speed disappeared in the clouds again. The spectacular sight left me gasping for a moment. Again the roar came, and again the little ship hurtled downward, up in a half loop and roared away on its back. It was Captain Gothlin testing a new plane.

Captain Oliver P. Gothlin Jr., Army Air Corps representative at the Boeing Airplane Company, is required to fly each ship a minimum of two hours before it is accepted by the government.

Attaining a safe elevation, his first maneuver is to fly upside down for a few seconds to shake out metal shavings, bits of material and anything else that might have been missed by the vacuum cleaner. Once a forgotten wrench struck him on the side of the head in its drop to earth. Climbing then to a height of several thousand feet, the plane is nosed over into a power dive.

With open throttle he plunges down a mile in twelve seconds, reaching terminal velocity of 350 miles per hour in 3000 feet. The propeller does not turn over fast enough to give more power and even the law of gravity does not allow an increase over that speed. In the first dive the wires are stretched and the plane "shakes down," an expression meaning that all the integral parts find their most comfortable positions, just as a new car loosens up in the first thousand miles of travel.

Captain Gothlin tries to tear off the wings in a succession of dives and thus far he has failed in that purpose. Instruments, controls and other operating mechanisms are checked in a series of wild maneuvers. By flying on his back, and rolling the ship, he determines the balance of the wings. The rolling test puts such stress on them that it is considered one of the most severe tests given to airplanes.

BUT the power dive and subsequent pull-out is the greatest test of any ship. Every part of consequence is strained, and a sturdy ship will survive but little more pressure than human eyes can stand. Pulling up from a dive, if it is done too quickly, a pilot will momentarily lose his eyesight and then his consciousness. A Boeing test pilot had such an experience not long ago.

HOW would you like to take a brand new army ship, just out of the shop and flight test it to see if it was strong enough to stand up under the work demanded of it by the Army?

Wouldn't that give you a thrill and the jitters, not knowing whether the wings were going to stay on or strip off?

Well, that's the daily job of Capt. Oliver P. Gothlin, Jr., who tries to tear a ship to pieces before it is finally accepted by the U. S. Army Air Corps. It's a good story—read it.

The Immelman turn is a reliable test of the maneuverability of a ship at slow speed. A dive, an upward half loop that puts the plane on its back in a reversed position, and a roll constitute the turn, which is one of Captain Gothlin's favorite maneuvers.

Attaches at the Boeing hangars say that Captain Gothlin in his regular test flights gives a more exhilarating performance than barnstorming stunt flyers do in the public exhibitions.

The Boeing Airplane Company's P-12 type greatly excels the other pursuit planes in the service and is the fastest ship of its type in the world. Of the 350 built for the army, a few were shipped to overseas posts but more than 300 have been tested by Captain Gothlin. Visit an army field some day and watch a P-12 in flight. It will give you a thrill worth a day's travel to see.

Results of tests and comparisons with fighting aircraft of foreign nations, as published in an official report by Major C. W. Howard, chief of the engineering section of the United States Army Air Corps material division, reveal the fact that the Boeing P-12E pursuit plane is unexcelled in its class.

"Without challenge, it has the highest rate of climb and is faster than any single-seater aircooled type in the world," says the Howard report.

With a full military load it is capable of climbing to an altitude of 10.000 feet and landing again in six minutes.

THIS remarkable time record is due in part to the P-12's ability to negotiate safely, a vertical no-lift dive. Instead of being exactly perpendicular. the ship is put over fourteen degrees from perpendicular on its back to offset the lifting tendency of the wings. thereby attaining a truly vertical dive.

A few months ago Captain Gothlin flight-delivered the second Boeing Y1B-9A bomber to Wright Field, Dayton, Ohio, where exhaustive tests were made. The Howard report heralds it as the outstanding international plane development of the year. This twin-motored, low-wing monoplane attains a terrific speed, and is capable of remarkable maneuvers surpassing all other multiple-engined planes in the service.

Test flying these Boeing types is but one of the many duties of Captain Gothlin. Engineering problems develop daily at the factory requiring constant attention. The change from fabric covered to all-metal fuselages necessitated endless tests and experiments. Problems of construction in the fuselage, failures of instruments, variations in material requirements, etc.—constitute matter requiring expert decision.

A staff of two secretaries and five inspectors attend to all detail work under Captain Gothlin's direct supervision. Each part is inspected after

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U. S. Army Planes

ALMOST unbelievable care is taken in building warplanes for the government. First come the various engineering calculations, then the laboratory tests on the materials and the tests and inspections made on the finished parts.

Finally, as a final test of the pudding, come the actual flight tests of the completed plane as described in this article. The flight tests not only require great courage but also an extensive knowledge of airplanes and their peculiarities.

Tests and comparisons with foreign fighting planes reveal the fact that the Type P-12 U. S. Army Air Corps pursuit ships have no equal in the world for speed and rate of climb.

each step in manufacture, and a final assembly inspection is made before the planes are taken to the hangar. And there they again undergo a rigid inspection.

A plane is delivered for flight test only after extensive factory tests have been completed. A testing department is maintained by the Boeing Company where the engineer in charge tests all grades and types of materials before they are turned over to the machine, welding and sheet metal shops for the various steps in manufacture.

Weight tests, chemical tests, pressure tests, and many more scientific tests are administered, and the results of each are observed by a government inspector. All the parts used in the final assembly,—struts, flying wires, engine mounts, wing sections, ribs, rudders, and so on,—are tested to determine the stress on each angle and surface before they are submitted for the final assembly.

THE weight of airplanes is a major consideration in their performance. Before construction begins, engineers estimate the weight within a very few pounds of the actual weight of the completed ship, which is, in the case of the P-12E, a little more than a ton. Each individual part is weighed as the assembly progresses.

The pursuit ship contains more than thirty different basic materials in hundreds of grades, types and specifications that are used in the manufacture of the required thirty thousand parts, irrespective of the power plant.

Practically all ships assigned to Army service within the United States are flight delivered. Army officers are sent to Seattle in groups of from three to fifteen to take delivery of the planes at the hangar and fly them to their posts.

Generally these men are young lieutenants not long out of training schools, eager in their dangerous work, and straining at the leash of discipline. Keeping them in bounds and handing over planes that will carry them safely on their cross-country flights is a responsibility greatly appreciated by Captain Gothlin.

And here is Capt. Gothlin, test pilot of the U. S. Army Air Corps as he appears on the field.

The real test of his work is in the attitude of ranking officers, flyers of great experience, some of them war aces who often take flight delivery. Their praise is unstinted. "When the captain is through with a ship there is nothing more to be done," the flyers at Boeing Field often say.

At thirty-seven, Captain Gothlin can look back on an extensive experience that began in the youth of aviation. After attending the Culver Military Acadamy and Ohio State University, he enrolled in the Army Air Corps ground school at Champaign, Illinois, on the twenty-second of July, 1917. The following November he finished the primary flying course at Scott Field and was commissioned on December twenty-sixth. He was assigned to Post Field, Fort Sill, Oklamoma, followed that with a squadron in Texas, and for five years served with observation squadrons throughout the country.

As a lieutenant he was commanding officer of the 165th squadron in Hawaii, remaining there from 1923 until 1926. During that period his active flying time was spent in pursuit planes. Recalled to the United States in 1926, he was assigned to the Rockwell Air Depot in San Diego, and left there to become Air Corps representative at the Boeing Airplane Company in Seattle in March, 1929. His promotion to a captaincy in the Army Air Corps came in October, 1930.

During this varied and extended service Captain Gothlin has flown nearly all of the service ships used by the Army until 1929, when he began his more concentrated work at the Boeing factory. There he flies all Boeing types and occasionally has an opportunity to take up one of the Douglas planes.

Danger and thrills have become so commonplace in the everyday business of testing pursuit planes and bombers that it is difficult for Captain Gothlin to select any particular experience as outstanding.

"I am still intact, so nothing I have done has been very dangerous," he said in reponse to my query, "but I can tell you about an incident I witnessed in 1917."

"It was probably the most unusual thing I have seen in the air," he continued. "Johnny Simpson was in the cross-country stage of his training and was soloing in a Curtis JN. As he passed near the field on one leg of his flight the ship nosed over suddenly. Johnnie's safety belt must have been unfastened because he fell forward in the cockpit against the control yoke.

The weight of his body against the controls put the plane in a sudden dive and threw Simpson out of the cockpit. At that time a wheel very much like the steering wheel of an automobile was attached to the top of the control yoke and he luckily retained his hold of this wheel."

GOTHLIN warmed up to his story, using his hands to demonstrate the action of the ship.

"The ship made a half outside loop putting it on its back, with Johnnie clenching his fists in an iron grip on the wheel. He had no parachute, and had a chance for life only as long as he could hang on. He struggled furiously trying to climb into the cockpit. His body swung forward with the effort, putting the control stick forward. This reverse effect to normal flight caused the ship to climb.

It climbed until the propeller would pull no longer. The ship stalled, fell off and again it dived. The dive threw Johnnie's weight forward on the stick, pulling the ship out of the dive, and causing it to climb again."

Captain Gothlin carefully demonstrated with a letter-head, and explained that all this time the plane was upside down with Johnnie swinging like a pendulum 2000 feet above the ground.

"He was losing altitude rapidly. We, at the hangar, were spellbound. The ship went into another stall, then dived, repeating the action three or four times. Coming out of the last stall, it had just nosed down when it hit the ground, flipped over and threw Johnnie clear of the wreckage."

"After two weeks in bed with minor injuries he was up in another ship determined to get his commission, and very careful to fasten his safety belt."

I had been warned that Captain Gothlin was very reticent, but this story of another pilot loosened his tongue just enough for me to hear about one of his own difficulties.

"Since coming to the Boeing plant my worst experience was with one of the early P-12 types," he began, "Johnny Corkille of the flight test section, Army Air Corps, informed me that while flying a P-12 at Wright Field he had experienced great difficulty in getting out of a flat spin. So I took a P-12 up one day to see what it would do from a stall."

A spin starts from a stall. When the angle of ascent becomes so great that the engine will no longer pull, and if the controls are still held in climbing position, the plane falls off and goes into a twisting, uncontrolled dive.

CAPTAIN GOTHLIN put his ship into a spin but nothing unusual happened. "I gave it some power trying to force it into a flat spin. My speed increased and I soon began to lose my sense of direction. The controls would not straighten me out. My

(*Concluded on page* 192)

The Transcontinental Fleetster

The Transcontinental Fleetster is a unique type of monoplane transport because of its parasol type wing.

HERE is a new cargo carrying bird, a Fleetster, just put into service by the Transcontinental & Western Airlines. It shows the trend in design for carriers of passengers, mail and express.

This ship carries seven passengers at a cruising speed of 145 m. p. h. and has a flying range of 750 miles. It is equipped with a single 575 h. p. engine, and as will be noted, is a monoplane of the parasol type—new to commercial airliners.

This arrangement of the wing gives almost perfect visibility for the pilot and is also said to considerably improve the performance and flying characteristics of the ship.

The Dirigibles TC-13 and Macon Near Completion

NOT to be outdone by the Navy in the matter of lighter-than-aircraft, the Army has been quietly going ahead for some months with the construction of the largest non-rigid airship ever built in America.

Goodyear Zeppelin engineers at Akron have been busily at work on the TC-13, simultaneously putting the finishing touches on the U. S. S. Macon, sister shop to the giant navy dirigible Akron. It is estimated that both ships will take to the air about the same time—early in April.

While the design and details of the Macon are well known, because of its similarity to the Akron, the TC-13 has had very little ballyhoo. It is 233 feet long and 54 feet in diameter. Including the car underneath, it has a height of 69 feet and a capacity of 360,000 cubic feet. Larger non-rigids have been built in France, but this is the giant of this country.

An unusual feature of the completed craft will be the presence of five control surfaces. These surfaces will be located at the rear of the ship.

The control car is of welded tubular construction with a covering of corrugated metal and fabric. Space is provided for three pilots, two mechanics, a navigator, radio operator, a bomber and with sleeping facilities, toilet facilities, a compartment for bombs, a sub-cloud car, and a radio set with a 3,000 mile range.

On each side of the car will be an engine of 375 horsepower, geared at a ratio of three to two. A three bladed

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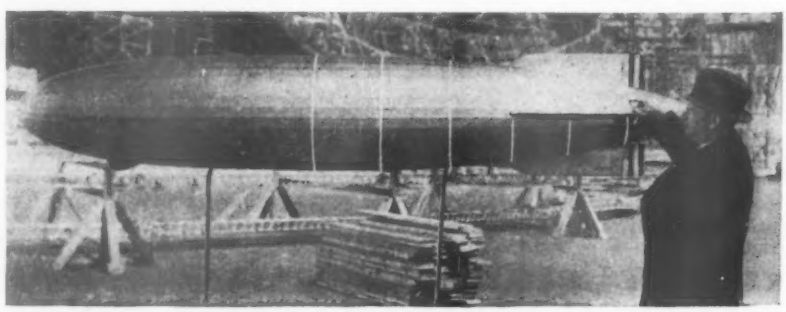


Here is a scale model of the "Macon," showing how it will appear when completed. Standing beside it is Dr. Carl Arnstein, the designer of the Akron and the Macon.

Training Errors of the A. E. F.

by CARL B. OGILVIE

How poor training ships, inadequate equipment and incompetent officers caused needless loss of life in the advanced training camps of the A. E. F.

A MOTOR thundered loudly as a plane—a Curtiss in England, but "Jenny" to you—darted along the tarmac of a Royal Flying Corps training center. The long winged, over-weighted and under-powered plane gathered speed slowly. Wings wobbled dangerously as it rose under an uncertain controlling hand.

Orders were, "Loop and spin the Curtiss and be promoted to Avros and Pups." But the general reaction of the American cadets at the field was as follows: "Loop yourself into a permanent dugout."

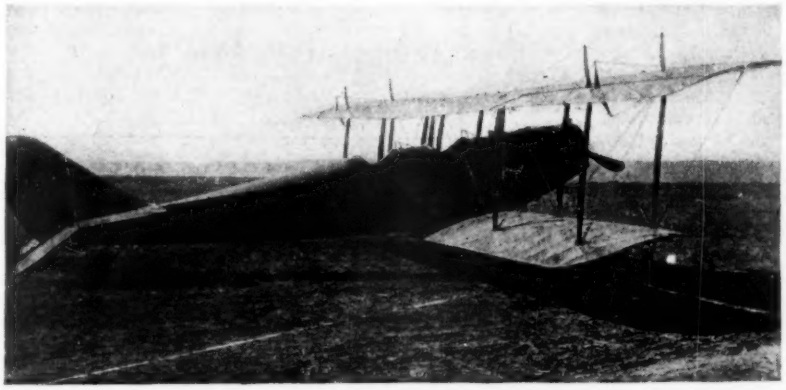
The American cadet at the controls of the Jenny didn't know how to loop nor spin. There wasn't a British instructor on the field that would risk his life to go up with him and show him how. All knew it was suicide to attempt such maneuvers with that type of antiquated primary training crate.

But the British were powerless to stop the pilot. Some American officer had issued the orders. The British flatly refused to have anything to do with such murderous orders. They ordered the pilots off the field and that was that.

But the pilot in the Jenny was anxious to get to an advanced training field. He wanted to get to France, where he could wing aloft and fight for his country. So he soared into the sky and climbed steadily. Climbed on the wings of death.

Reaching the desired altitude, the American cadet gave the motor the gun, dived—then pulled the stick far back. The Jenny dived, then nosed upward abruptly. Half way over on its back at the top of the loop, the wings collapsed under the strain they were never intended to undergo.

From an altitude of several thousand feet the fuselage, with its helpless pilot, plunged earthward. The wings fluttered downward like falling leaves. Aghast, everyone watched the pilot crash to his death. And all because some square-headed swivel-chair officer in France, recently promoted to the Air Service, had said cadets should loop Jennies as part of their training.



The much maligned old Jenny, designed for a primary trainer but used for advanced training with disastrous results.

THAT brave, ambitious American lad was Cadet Ainsworth, a member of one of the first two groups, totaling 204 Yankee cadets, sent to England to receive flying instructions from the R. F. C. And it is the story of the first fatality suffered by the American detachments at British aviation training fields in England.

I read it, briefly sketched, in the most unusual wartime diaries ever shown to me. A diary kept by a member of those cadets who hearkened to the call of patriotism and to appease the lust for adventure surging through their young bodies.

Later they became famous as War Birds in a book by that name. Because it is so exceptionally different from any other personal document to come out of the war I urged that I be permitted to quote it for the readers of POPULAR AVIATION.

It is a strange document—that notebook. The cadet who wrote it now lies somewhere in France. It is not a record of his personal achievements, his ambitions nor discouragements at British training fields, nor is it written about himself. It is a solemn and tragic record of other men. Doomed men. Young men who gave their all to win wings of glory.

But this worn, thumbed notebook is not a morbid and depressing document. Quite the contrary—it is a curious admixture of notations of tragedy and intermingling humor. Between its lines lies—unwritten—its writer's growing indifference to death and the fatalistic or philosophical acceptance of the inevitable so common among young flyers during that or any other time.

In its brief and terse comments I find its charm, its breezy personality and unflagging interest. The laconic comments paint a picture with a word or two. What I have found at times required several paragraphs.

And if you feel that a man who kept a record of accidents—a list of death—was a morbid individual, fling the thought from your mind. It merely indicates that the writer, who must remain "unknown" in this article, was a particularly level headed young American. Carried away by a strong emotion of patriotism, as were we all in those strained days of nineteen-seventeen and eighteen, he had enlisted in the Air Service.

He lived and enjoyed life to the hilt. He wined and dined with his buddies. but the Hip-hip-hooray of war was a false note to him. War was something vivid, real and tragic. Men go to war to fight, to kill, or be killed.

He either sensed or realized what we all know now—that the duty of an airman was by far, more hazardous than any other branch of the military service; even more dangerous than that of the Infantry. He saw the weakness of the structure of training requirements—looping Jennies for instance, and the compulsory order of spinning Camels, foolish and extremely hazardous requirements.

Stirred by the growing losses of cadets, apprehension hung heavy in his heart that at the rate students were being "washed out" there would be none of them left to reach France. It must have been a desire on his part to prepare an authentic and accurate report of the causes of training casualties that brought the diary into existence.

IT IS an impossibility to place the responsibility for the seemingly high rate of casualties of those 204 men he wrote about. I'm not going to, for the writer of the diary didn't attempt to place blame nor solve the insolvable. It may have been due to lack of harmony and understanding of training methods between American and British officers. Or it may have been the inevitable result of England's

desperate need of pilots at the Front that cadets did not receive the careful primary training necessary.

Training in America and England was a hurried and hectic affair. But it is a startling fact that the percentage of training casualties in England were amazingly greater than those in either the United States or France.

In training schools in America during the war period, air cadets flew the tremendous total of 64,000,000 miles, figuring their hours in the air at 80 m.p.h. This distance is the equivalent of 2,568 flights around the world at the Equator. One death, due to accident, occurred for every 2,960 hours or 236,800 miles of flying.

In England the casualties suffered were high, as 34 deaths occurred out of some 400 American cadets who flew a total of only 20,624 hours. This leaves a high rate of one American killed, while training in England, to every 606 hours of flying, or a rate thirty times greater than that in the United States. In France the death rate for student pilots was lower than England, but ran to one for every 931 hours flown.

High as the training percentage of fatalities were it is tremendously low compared to the life of a pilot at the Front. Of 216 American pilots breveted in England and sent to R. F. C. squadrons at the Front, a total of 95, or 44 per cent were put out of action by the date of the armistice.

Let's see what this "put out of action" represents. There were 23 known killed, 18 wounded, 23 prisoners, 1 interned, 4 discontinued, 1 transferred and 25 missing. This total, figured against the number of days of service gives the average period of usefulness of a pilot in active advanced area duty as 68 days. This is most conservative as many of those killed saw less than 2 months service in the Zone of Advance during the war.

It is well in reviewing totals to note that in every instance those reported "missing" exceed the total known killed in action. The total number of American pilots killed in action are estimated at 164, while the missing are listed as 200.

Now it may be difficult for the reader to understand how and why a large percentage of cadets were killed while flying training ships. Many accidents were due to the failure of the man himself, or failure of equipment; many cases the cause never was determined. I found in the diary a list of the greatest number of accidents resulted from the following causes, in the order of their importance:

MOST of the fatalities resulted from tailspins; collisions in mid-air and sometimes with ships on the field took the second heaviest toll; nose dives, with the pilots powerless to pull their ships out, were listed as the third greatest cause of casualties; stalled

(*Continued on page* 192)

Believe It or Not—This is no Fake!

From all appearances, the huge German flying boat is hovering in front of its hangar like an Autogiro, but actually it is doing nothing of the sort.

HERE we see the return of von Gronau from his Round-the-World flight, the ship standing still and suspended in mid-air directly in front of the hanger at Friedrichshafen, Germany.

As this is not an Autogiro, but simply a flying boat, how do they get away with it? We'll admit that it looks fishy, but it is not. The boat is really suspended from the cableway and trolley by which it is run into the hanger. But, at first glance, it looks bad for the spectators on the dock.

The Guillemin J. G. 10 Meets With Favor

A NEW airplane, characterized less by striking and original features of design than by the general care with which the comfort and safety of the passengers have been arranged for, has appeared on the flying fields around Paris very recently.

In less than two months from the date of its first trials it has already met with such a popular response that it has been placed in quantity production at its plant.

This is the Guillemin J. G. 10, designed by the pilot Guillemin originally for his personal use as an aerial automobile—a definition that it fulfills very well. It is a sedan automobile airplane with a demountable hood that can be removed with ease by the aviator and without special tools.

In accordance with this characteristic, hood, wings and fuselage alike have been doped with a special weather-resisting compound that permits leaving the machine outside of a hangar for long periods of time without damage. This equipment is completed by a canvas treated in the same fashion with which motor and propeller can be covered. In a recent test, a Guillemin J. G. 10 was left out-doors for two weeks in all kinds of weather without very noticeable damage.

It is a two-seater with the seats placed diagonally. There is a roomy luggage compartment and the parachutes are installed on the outside of the machine in special pockets, furnished with automatic detaching arrangements which will operate in case of accident in the air.

In construction, the Guillemin J. G. 10 is a low-wing monoplane, the wings being of cantilever construction and entirely of wood.

A side elevation of the Guillemin J. G. 10, a French convertible two-seater that is becoming popular.

Seen at the Paris Aero Show

WARPLANES were of less importance at the last annual aeronautic exhibition while commercial machines gained. There were comparatively few foreign exhibitors this year, most of the machines being of French origin, with a spattering of English, Polish and Italian airplanes.

THE XIIIth Salon de l'Aviation, which has recently been held, attracted crowds of Parisian and foreign visitors.

Unlike the Salon de l'Automobile, the prime object of this Exhibition, which takes place every two years, is not so much to obtain immediate business at the Show itself as to create propaganda for the airplanes. In this, it is probably successful, as the public can get much better acquainted with the construction and details of airplanes at the Salon than it could at any airport.

On the whole, the Salon is a little less important than two years ago. All the French constructors are represented and the French Government has, as usual, a section showing the various types of planes used by the different Services, but the German and Dutch constructors are absent this year and foreign participation is also less important.

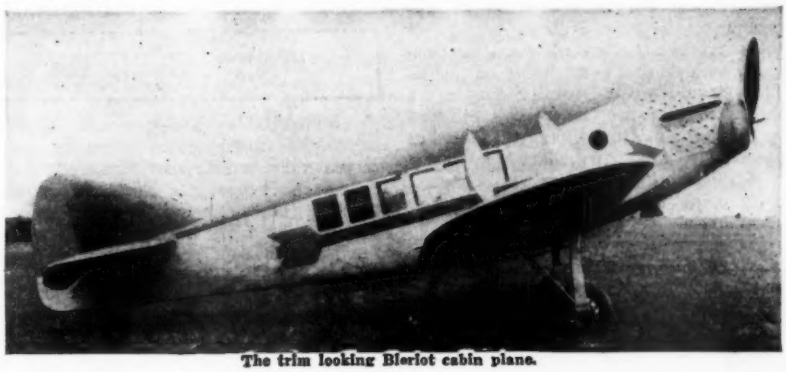
The British exhibits consist of a few high-class planes and engines and Italy has arranged a collective exhibition comprising five planes of different makes and a number of engines. Poland has sent four planes, mostly war machines.

The largest plane this year is a Transport for the transportation of passengers and merchandise, built by the Etablissements Liore & Olivier. It is fitted with four engines. Another machine intended for the Salon, is an amphibian of 23 tons built by Bleriot. It was found too difficult to bring into the hall and is being exhibited at the works.

There are two features which must impress the average visitor at this year's Salon. The first of these is the much smaller number of fighting machines, compared with former shows, the majority of the planes exhibited this year being commercial types intended for touring purposes, the transportation of passengers, mail, etc.

This is perhaps the best illustration obtainable of the evolution which has taken place in aviation during the recent years, because visitors of former shows will well remember the planes fitted with machine-guns and bomb-

The Italian "Breda," an O. C. job finished in red and white.



The trim looking Bleriot cabin plane.

A Farman 4-Seater, Type F-351.

The Farman-Renault Conduite Interieure Moteur.

dropping devices which in those days formed the principal attraction, if not almost the bulk of such exhibitions.

The second feature and a very striking one, is the great progress and improvement made in the outward appearance of the planes, this being due to greater care and still more, to the adoption of new finishes. About 65 per cent. of the French constructed planes at the Salon are finished either in Dulux or Duco.

Apart from a number of planes ordered by the French Government and finished in regulation light Grey, the finish most generally used is aluminum, but among the smaller planes there are a number which are painted in very bright colors. The use of more effective finishes will certainly lead to a greater use of color combinations and schemes of decoration. The Farman planes, Hanriot's Autogiro, the planes exhibited by Bernard, Potez, etc., as well as some of the Italian exhibits, are clear evidence of a strong trend in this direction.

The use of metal (Aluminum alloys) for the construction of planes, is certainly on the increase but at the same time, from the point of view of appearance, the new finishes impart to other materials such as wood or canvas, the look and smoothness of metal. The four Morane-Saulnier planes at the main entrance, which are finished in Aluminum Dulux, have the exact appearance of burnished metal.

Metal propellers are well in evidence, both on planes and in the Section for accessories.

Stainless steel for the construction of planes, such as shown by a British exhibitor, does not seem to have yet been taken up by many of the French constructors.

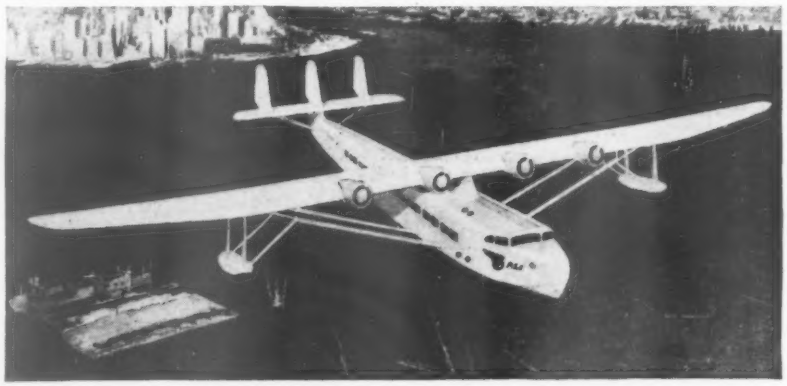
And just what does the absence of warplanes indicate, when we know that warplane development is the greatest present activity in aeronautics among all of the European countries? Is this intended as a blind to cover up their latest developments or are these countries really suppressing the idea of war?

Whatever the military situation may be, however, it is certain that the Paris exhibition does not display as many original developments or radical designs as were shown at the Berlin show that preceded the Paris show. There is an entire absence of radical changes and only the most conventional types are shown.

Perhaps there is one departure, and that is the Bleriot boat, which however, was not displayed at the main show. This, following late Bleriot practice, is a sizable double hulled flying boat, the counterpart of which was shown on the cover of POPULAR AVIATION, September, 1931, issue.

This show makes one think of the auto shows of about 1920, when the closed sedan was rapidly succeeding the open "touring car." In the same way, the ships shown at the Paris show are mostly closed jobs with only an occasional "O. C." among them.

Here is Lindbergh's Ideal Transport



This is the proposed clipper-ship of the Pan-American Airways, the Sikorsky S-42.

A NEW trans-oceanic clipper ship, the Sikorsky Model S-42, has been designed for the Pan-American Airways under the specifications of Col. Charles A. Lindbergh.

This four-engined plane will carry 50 passengers and is said to be a tremendous advance over any long range transport yet developed. It is also equipped to carry mail and freight as well as passengers although its payload capacity has not yet been revealed.

The Newly Discovered Raimondi Effect

A STRANGE aerodynamic effect, which until quite recently has rested unknown, is now disclosed.

The effect presents itself as an attraction between two bodies, one of which is rotating at high speed while the other is kept stationary.

If the plate (A), Fig. 1, is rotated at a speed of about 1900 r.p.m. around an axis located a short distance from another plate (B), then these two plates will attract each other with a force of over a pound.

This attractive force increases with the speed of rotation and then decreases when the distance between the two plates increases.

With a rotating cylinder, as shown in Fig. 2, the attraction is less and the cylinder must rotate with a velocity of about 2700 r.p.m. in order to provide the same effect.

If, however, the stationary plate is replaced by a stationary cylinder, as shown in Fig. 3, then the attraction is much increased and with a velocity of only 1200 r.p.m. it amounts to over 2 pounds.

This effect was recently disclosed by Col. Raimondi at the Congress for Science Progress at Florence, Italy. The investigation of the effect is only in its first experimental stage and has proved quite baffling to science as it is exceedingly hard to explain and very difficult to approach from a mathematical angle.

It is, however, easy for the amateur to repeat the experiment as the necessary equipment is soon built by following the dimensions given in the figures. Any material as wood or cardboard will do.

Keeping in mind the similarity with the Magnus effect which, almost forgotten, made Flettner's Rotorship possible, the Raimondi effect may prove to be the basis for important future inventions.

Perhaps, this effect may be employed to improve the lifting capacity of wings or even as lifting surfaces within themselves. At first glance, it would appear that the arrangement in Fig. 3 could be applied to a Flettner rotor, perhaps as a clutch.

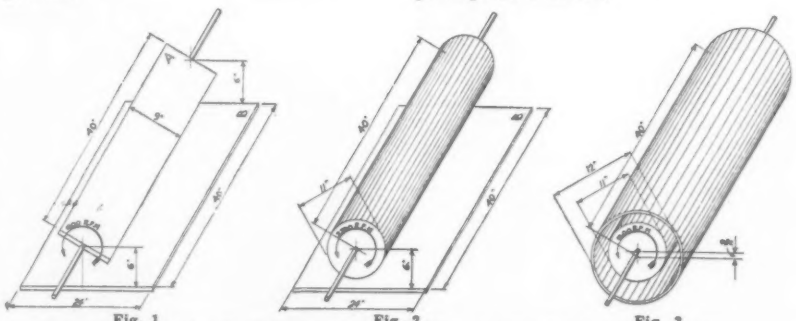


Fig. 1 Fig. 2 Fig. 3

Diagrams illustratting the Raimondi effect with different types of rotor and stator plates.

Mosquito Hunting New Aviation Sport

"MOSQUITOES to the right of them, mosquitoes to the left of them, and mosquitoes in front of them," paraphrasing the Light Brigade classic, was the nightly experience of aviators in Hawaii not so long ago. Sleep came hard, the venomous attacks of the winged pests continuing through the night.

It was with eager celerity, then, that members of the 18th Composite Wing, Army Air Corps, acquiesced in the suggestion made by the Territorial Board of Agriculture and Forestry, that the flying men cooperate with the Board in a series of "mosquito hunts," in attempts to discover the breeding places of the insidious insects.

A special trap, made up of a series of screens coated with a resin-castor oil solution, was mounted in the front gunner's cockpit of a giant bombing plane, and so arranged that the separate screens could be exposed individually and at will. Two Army pilots were assigned to special duty of the "Bug Chaser." For once in a lifetime, Air Corps rules were suspended for their special benefit, and the enjoyable stunt known to flyers as "hedge hopping" was permitted.

Aloft for a total flying time of about six hours, a distance of 270 miles was covered by the airmen. Three day-flights were made, and two at night, a total of approximately one-and-a-half million cubic feet of air being estimated to have passed through the screen traps on the five flights.

The strange thing, however, is that *not a single mosquito was captured on any of the trips!* Instead of being an unsatisfactory result, though, the report was considered quite acceptable, for it bore out the theory that mosquitoes do not fly to any great altitude above ground, nor, because of limited flight endurance, do they fly to any great distance from their breeding grounds.

All of which, according to the unsuccessful mosquito hunters, proves that the pest is purely a local problem, and that he does not stray very far from the swamp or pool in which he first opened his eyes to the light of day. Anyway, the hunt produced some additional results for the benefit of the 18th Composite Wing—For some reason or other, the unblessed buzzers have steered clear of the sleeping rooms of the flyers, since the period of the investigating flights! Believe it or not!

A Good Swap

A 79-YEAR-OLD flying enthusiast, Austin I. Bush of Niantic, Conn., has completed a deal with the National Guard detachment of that city whereby he accepts one half-hour plane ride a week as rent for his land used by the Guardsmen as a drill field, target range and airport.

Seaplanes Adapted to Rescue Work

The lifeboat has just been inflated and is now ready to drop in the water from its cradle located on the wings.

THE accompanying photos show the application of a rubber pneumatic life boat that can easily be carried by a seaplane when engaged in life-saving operations over water.

The rubber life-boats are inflated from a carbon dioxide gas cylinder carried by the seaplane and they can be completely inflated in 15 seconds. The life-boats in this case are filled by an "injector" which draws pure air with the gas during filling and thus allows the inflation to proceed more rapidly than with the gas alone. After inflation, the rubber life-boat can be propelled with oars or by a small sail.

After being used, the rubber life-boat is hauled aboard, is deflated and is then restored to its crib on the wings. The inflation and deflation take only a few minutes and the method is therefore well adapted to emergencies.

This requires a seaplane of considerable carrying capacity, possibly with accommodations for five or more persons, for the plane must carry both the crew of three men and the persons rescued. Just at present, this is a "fair-weather" method that is applicable only to fairly calm seas, but even with these limitations it performs a most useful service.

U. S. Navy planes have carried small rubber life-rafts for some time which are hardly more than life preservers in point of size, and gas inflated floats have also been devised for the flotation of a disabled airplane, but coastguard rescue ships require more than this to effect rescues in the case of overturned boats and similar accidents where it is probable that unconscious persons must be handled.

There is a great future for further development along this line, and the present set-up illustrated here is only in the nature of an experiment. In place of the seaplanes, it is likely that planes of the flying boat type would prove far more acceptable.

The lifeboat is launched and is being paddled to the assistance of the ship-wrecked party. For longer distances, the boat is provided with a mast and sails.

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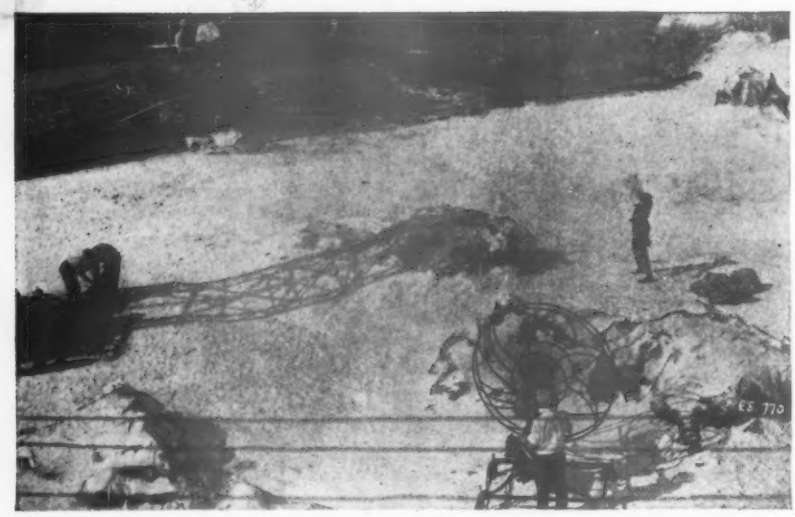
How A Thrilling

by

LIEUT. HORACE MAZET



Ship-wrecked in a desolate expanse of corn-flakes! The summer scene is in the background—a strange contrast to the mock snow-fields in the foreground. The wind-machine meanwhile delivers its chilling blast—and the play goes on.

ROARING motors—flashing wings—fearless flyers braving snow, ice—unseen mountain crags. Raging storms among the clouds—and the mail goes through! But it is all part of the day's work for an airmail pilot—flying blind in a blanket of fog—gambling with death for duty's sake.

In mid-air, with landing gear gone, a wing shattered, the hurtling plane tears itself apart against a mile-a-minute gale—one parachute and two flyers!

The mighty air power of the army and navy to the rescue—flight squadrons roaring through the clouds in search for a lost pilot of the airmail service—the whirr of propellers, the screams of singing struts as the intrepid airmen wing their way through the night.

"Airmail" is the movie containing these thrills. Of course, it was made to draw patrons to the theaters, but it is a distinct tribute to the solitary figures who speed through the clouds and night that the mail may go through. Again, it is authentic, for it was written by Lt. Comdr. Frank Wead, U. S. N. (Ret.) who was responsible for the stories behind the superb aviation pictures "Flying Fleet," "Dirigible" and "Hell Divers."

Lt. Comdr. Wead is a native of Peoria, Illinois, and a graduate of the Naval Academy. He saw extensive war-time service in the Navy prior to his accident when he fractured his neck falling down-stairs. This led to his retirement. His war-time occupations included laying a mine barrage in the North Sea, a most dangerous mission. Turning to writing after his naval career was checked, he has given the photoplay public many action masterpieces including those named above, and he is well known to the older readers of POPULAR AVIATION who undoubtedly remember his contributions to this magazine.

Dale Van Every, co-author of "Airmail," was born in Michigan and received his A. B. at Stanford University. He served in the ambulance corps of the French Army before starting his career as a film writer. Together, these men have succeeded in presenting mail flying in a most spectacular way.

And now for a little inside information on the making of the picture.

From ballyhoo man for a traveling tent show and stage carpenter, to the leading part in this fast-moving tale of airmail pilots, is the history of young Ralph Bellamy, new screen star. During the filming, he usually occupied his leisure hours by hunting up the script, as becomes a new leading man, and analyzing the next scene carefully.

The humorous Slim Summerville is also in the play, but he was fond of digging up his corncob pipe between scenes, to smoke contentedly, or now and then play a game of checkers with Russel Hopton. Gloria Stuart, the beautiful blonde feminine lead and a new find for the films, usually donned reading glasses and applied herself to a book, unless she was interrupted by Frank Albertson, a noted practical joker.

Lovely Lillian Bond, as well as the pugnacious he-man, Pat O'Brien, also have their characters in the filming of the sequences. Here, of course, the service flyers are used in the scenes devoted to them, but the "movie" shots of planes in the story were flown by two well-known veterans, Jimmie James and Paul Mantz. But more of them later.

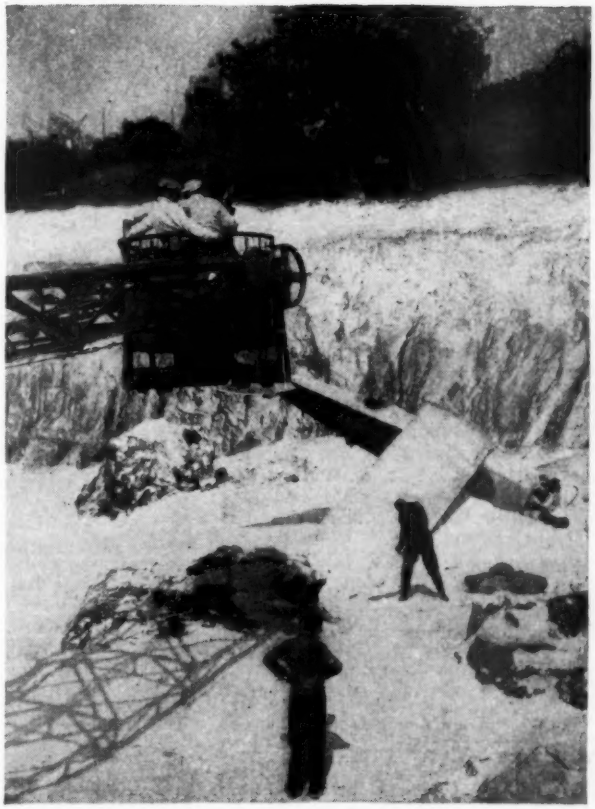
MANY interesting anecdotes grew up in the studio while this film was being made. For instance, a temporary halt in shooting was called when

And here's the close-up of the scene, as the audience witnessed it. Mighty realistic, even though it was taken under a hot California sun.

Air Movie is Filmed

NO MATTER what we may think of the photoplay Air-Mail from an aeronautical standpoint, yet we must admit that the studio mechanism for producing the play is highly ingenious.

Here the whole secret of taking this play is unfolded before you in the most interesting manner including all of the tricks such as the electric-fan propelled blizzard, the cornflake snow and all the rest of the studio stunts. Much of the work, however, was real flying and when we say "real," we mean real. What pilots!



The director, camera man and camera are mounted at the end of a travelling derrick so that they can be quickly shifted to any part of the scene without readjusting the camera. Note the summer atmosphere in the background.

something went haywire with the fog machines and the sound stage was suddenly enveloped in an impenetrable mist.

The fog machines, which spray a fine blanket of patented oil compound which appears on the screen as a fog, were being used to imitate a severe weather condition through which the planes had to fly. But the control valves were opened too far and the set was wrapped instantly in a vapor so thick that the camera lenses could not penetrate it.

The studio "snow" used in the mountain scenes actually caused several cases of snow-blindness in July, although the material was really several carloads of corn flakes imported from Battle Creek, Mich. After Pat O'Brien and Ralph Bellamy complained of severe eye-pains, smoked glasses were ordered for continuous wear.

Photography taken in the clouds (real shots this time) was accomplished by an automatic camera mounted on the "camera plane." It was operated by the pilot through a synchronization gear connected with the engine thus permitting the pilot to fly and be camera-man at the same time.

Although the public has grown to look with a jaundiced eye upon feats of daring in the movies, due to "processing" and other technical methods of providing synthetic thrills, screen actors are still frequently called upon to risk physical injury during picture shooting.

Aviation films are, naturally, rather difficult to photograph convincingly unless the risks are real. Certain sequences still defy trick photography. In "Airmail," a week of hazardous camera work was completed with scenes wherein the principals exposed themselves to continual danger in night-flying scenes, fighting the real flames of burning planes, scaling beacons and other script requirements permitting no "doubling." Burned hands, bruises and sprains were among the minor injuries suffered by the male characters, for three airplanes were crashed to secure the vivid wreck scenes.

Pat O'Brien's part called for a number of possibly hazardous and difficult scenes, and immediately after the Irish actor had finished his lecturing an attentive group on what a valuable asset "cocksureness" was, Director John Ford outlined the next scene for him.

"It's a pretty dangerous stunt," he said. "Do you think you can do it all right? Maybe we had better get a double. Say!" He beckoned for an assistant.

"Wait a minute!" Pat O'Brien stepped up to the film mentor. There was a hard glint to his eye and his Hibernian jaw protruded so you could notice it fifty feet away. "What do you mean—extra? There isn't any extra who can do that like I can. Call that guy back. Let's go!" Cocky? Sure.

THE real fancy flying for the picture was the work of the two pilots, Mantz and James and most of the scenes were shot at the Metropolitan Airport, Van Nuys, California, just outside Hollywood. Jimmy James is the master pilot for Western Air Express, Inc. He served 19 months overseas as a first lieutenant in aviation, seeing actual combat work in the war.

Upon returning to America he entered commercial air service and flew the first mail to Los Angeles in April, 1926. He also flew the first night section of the trans-continental airmail out of Los Angeles, so that he may be taken as an unquestioned authority for the details in this picture. His total air time exceeds 6,000 hours of which 4,500 were flown on airliners. James is one of the real old-timers in aviation, and one of the earliest mail pilots. It is he that flies the big Boeing ships in this feature.

Paul Mantz learned to fly in the cadet corps of the army at March Field, Calif., and it was while serving as second lieutenant in the Air Corps that he participated in the production of his first film "Hell's Angels," that stupendous spectacle of two years ago.

He then took up commercial aviation at the United Airport, Burbank, California, and flew as instructor, forest patrol pilot, and occasionally in motion pictures. In 1930 he broke the record for consecutive outside loops, making 46, which at that time was considered marvelous although it has since been broken. He is recognized as one of the foremost stunt fliers in the motion picture industry.

Approximately 100 hours of actual flying were consumed in filming this aviation picture, including rehearsals, retakes, cut-out shots and everything. The equipment consisted of one Ford trimotor air liner, three Boeing mail-planes powered with Hornets, one Stearman forest patrol plane powered with a Wright J-5, one Travelair with a

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125 h.p. Kinner and a Buhl Air-Sedan powered with a 300 h.p. Wright.

Mountain flying in the high Sierras presented risks as the pilots flew close to the peaks during shooting. Maneuvering close to the ground, stunting and even inverted flying—not to mention a dive through an open hanger—contributed to the excitement. That hangar flight was actually done three times, using both the Stearman and the Travelair. A slight miscalculation in judging distance would have proved serious.

RARIFIED air made the take-offs in the mountains especially dangerous because it was only possible to gain altitude slowly and the planes had to zig-zag through the passes with heavy camera equipment. The pilots never had a great margin of safety in the thin air of the mountains where they were forced to fly spectacularly at times even when the script did not call for it. And night landings on improvised fields presented another definite hazard. Taken all in all, much credit goes to the two pilots who performed for this film, but who get none of the ballyhoo and publicity.

Slim Summerville, comedian, had a close one when Mantz dived down on him in passing through the hangar. The landing gear struts whistled past his ears, and if he had moved to either side he probably would have been decapitated.

Later on, Mantz was forced to make a dead stick landing more than once upon the completion of his stunts when the engine died. It cut out at one time 150 feet above the ground—but he made a safe landing.

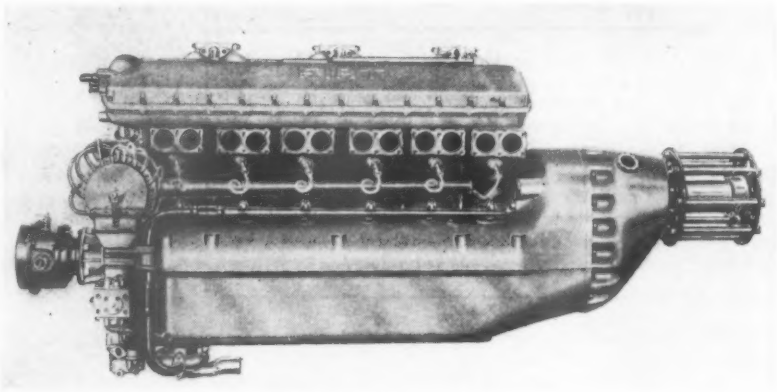
During a warming-up of the Stearman, with the engine turning up 900 revs., the chocks slipped out and the plane was in motion, headed straight for a camera crew and troupe members! But quick-witted workers grabbed the wing extremities and held the ship until Mantz climbed in the ship and switched off the ignition.

Pat O'Brien took lessons from Mantz while on location and passed some 50 hours in the air during the filming. His instructor said: "Flying in accordance with the demands of the script involved the hardest job of maneuvering I have ever encountered. It was necessary to be more keenly alert than on any other flying job I have experienced."

"Not only were the feats called for more intricate to execute, but they had to be accomplished in weather conditions which were different from those ordinarily encountered in orthodox flying. The heat and thin air made maneuvering almost a matter of chance."

The photoplay "Air Mail" is a mosaic, built up alternately of ingenious mechanical apparatus in the studio combined with actual risky stunt flying by daring pilots. When the risks from crashing became too great, then the studio took up the task of fooling the camera by fake photography.

The F. I. A. T. Engine Type A-30-R



Side elevation of the F. I. A. T. A-30-R aviation engine shows a compact clean-cut job.

THE F. I. A. T. company has introduced a new 12-cylinder aviation engine that is fully up to the exacting standards established by this well known Italian automobile manufacturer. This is the type A-30-R which is the offspring of the high-duty engines designed for use in the Schneider Cup Races.

The F. I. A. T. engines have had a long and noteworthy string of victories to their credit. They won the Schneider Race of 1926, and in 1928 they won the world's speed record at Venice.

This 12-cylinder water-cooled engine develops 560 h. p. at 2,600 r. p. m. The cylinders are of forged steel with flat compression chambers, and an efficient gearing system reduces the engine speed to the proper propeller r. p. m. A shock-absorber is placed between the engine shaft and the transmission gears which absorbs the vibration and lessens the shock on the teeth of the gears.

Three F. I. A. T. carbureters supply the liquid fuel which is not gasoline but a mixture called the "A. S. 3." which consists of 55 percent. Avio benzene, 23 percent. alcohol and 22 percent. rectified benzol. This mixture is fed by a pump.

New Plane Resists Bullets in Test

MANY efforts have been made toward building a bullet proof war plane without success, but a recent American ship shows promise of success.

A. K. Longren, the inventor, an old timer in aviation, has demonstrated the practicability of his armored ship by actual test. The skin of the ship resisted the firing of bullets at Roosevelt Field.

The armor consists of duralumin plates riveted together, and because of the shape of the plates, the bullets are deflected without causing any damage.

Probably, the next step in proofing warplanes against bullets will be the protection of the propeller and landing gear. Of the two, proofing the prop will be the most difficult problem to solve.

Here is the bullet-proof plane with A. K. Longren, the inventor, standing by it (at the left).

The Hazards of Aerial Mapping

by KENT SAGENDORPH

Gathering all sorts of topographical data with his aerial camera, in all parts of the world, Sydney Bonnick has had some hair-raising experiences.

SYDNEY O. BONNICK is just a name but the man who bears that name is the mystery man of the air. He has flown with pilots who never knew his name nor his errand, and he has spent thousands of hours cruising high above the waste spaces of the world.

He is a sort of flying detective, but he is not working for the Law. In fact, although he has been doing this secretive sort of flying for more than twelve years, there are not a half-dozen persons in the world who know anything about him nor his mysterious flittings, hither and yon.

He is a sort of legendary character like the Flying Dutchman. All sorts of stories have been told about him; some of them true, most of them fables. He gets the credit or the blame just the same. The facts about his sensational career are sufficiently interesting in themselves to justify a great many inquiries about him, but he shuns the spotlight. He is an inquisitive aerial photographer, and he trains a powerful camera down upon our homes and our lives—often without our knowing about it.

He is up there so high you cannot hear the roar of his motor, nor see the T-shaped outlines of his plane. But he can see you in the most embarrassing detail. He might be three miles above you now, counting the washing on your line and you wouldn't know a thing about his visit. Then he goes in search of tax dodgers — mountain ranges—river sources—new oil-producing areas—gold veins. Consequently his record-breaking flights are not greeted with salvos of publicity by the press. He is paid very well to keep them quiet.

Pilots who have flown with Bonnick for years still know nothing about him at all. Oh, he talks. But not about the objects of his flights. He chatters for hours about his marvelous aerial camera, that freak of the scientific world that so few persons understand. He likes to show his collection of photographic studies of this old world, taken from many miles above it.

Right. An unknown waterfall on an unknown river discovered by Bonnick.

Below. Sydney Bonnick in flight togs.

For Bonnick is one of those very rare individuals who go places and do things in a hair-raising atmosphere of nervous tension, imminent danger and unknown perils. His experiences have furnished skull-scratching authors with many a hectic plot.

FOR instance, picture a situation like this: Bonnick, swathed in leather and fur, bending over intricate instruments in the swaying cabin of a big airplane. The temperature is sixty below zero and the altimeter reads nineteen thousand seven hundred feet. Miles below are the mesquite flats of central Mexico where sun-browned natives curse the torrid heat. Under his fur gloves are the controls of his electrically-driven mapping camera which is busily ticking away as it records mile after mile of the country below.

Lazily the plane drifted toward an oncoming cloud. Bonnick's pilot was preparing to pass through, as he always did—then something happened. Inside that black cloud was a miniature tornado which gripped the plane and nearly tore it apart before the two men had any warning.

It was pitch dark outside the windows and all the instruments went crazy at once. The rate-of-climb indicator went backwards so fast that it broke. The airspeed meter swung around to 165 with a jerk and stuck there. The altimeter needle whizzed around backward in thousands of feet like the second hand of a watch in reverse.

Inside the cabin was havoc. Loose equipment was banging against the walls: the two men were clawing for a handhold and the ship was trembling and bucking as it plunged earthward

The first aerial photo of the crater of Mt. Popocatapetl, the Mexican volcano.

through the darkness. There was a shudder as one aileron ripped off—another as the remaining one was slashed away. The downward speed was better than 300 miles an hour, and the cabin was full of stuff floating freely around inside. The last aileron, as it zipped out of its wing socket, knifed off the whole counterbalancing frame of the rudder and about half the linen on the remaining part.

The pilot, who chooses to be nameless, saw the rocky backbone of a mountain range rushing up from below the cloud, less than five hundred feet below. They were falling wing-tip first. It was a chance, the pilot said, to put a pet theory of his into action. He therefore wriggled the remainder of the rudder to force the ship into a still-steeped side-slip. He thought it would do one of two things—rip the whole wing off or twist the ship back to normal. The wing didn't come off, and the nose did come up a little.

IT WAS a hundred and seventy miles back to the Tampico airport, and on the way back the ship fell out of control five times. Parts of the wrecked ship had fallen among the mountain passes, alarming the Indians up there, who wig-wagged the news to a telephone station. The message was relayed to Tampico and all the available planes were out on the line warming up to go and extricate the bodies when this ruin hove in sight.

They came sliding in on what was left of the rudder and a wobbly wing, and made a three-point in the teeth of a fifty-five mile gale that was blowing up the dust on the field.

This pilot is now in charge of all flying operations for one of the biggest American aviation companies, and deserves it. It was just an incident to Bonnick, noteworthy only because he had to write a letter to the owner of the plane explaining why he had a repair bill.

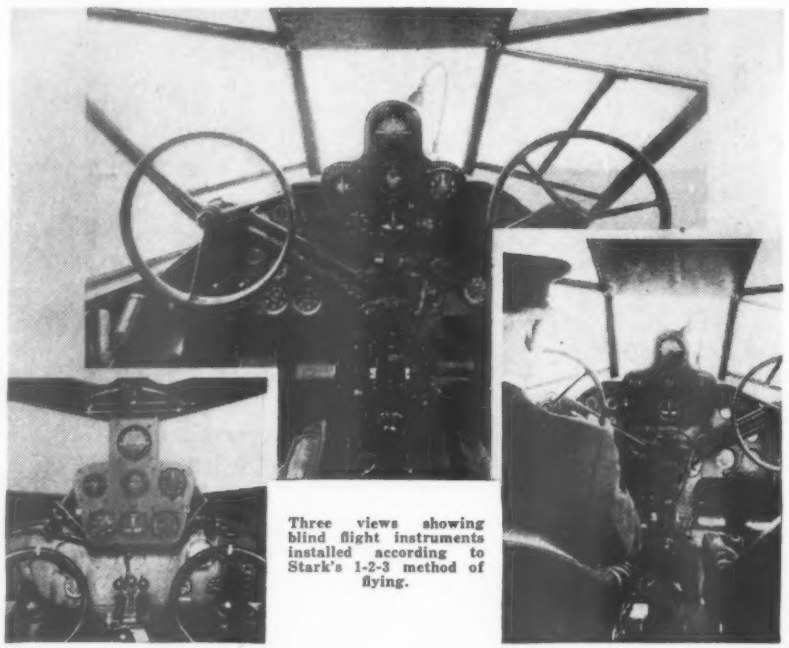
Then, there was that exasperating occurrence at Niagara Falls which annoyed him because it got his name in the papers and he prefers to remain anonymous.

He was in the back seat of a little underpowered biplane, weighted down by a huge aerial camera, determined to get some trick pictures of the Falls for the rotogravure section of a newspaper.

Well, they got down into the Gorge to get some close-ups of the Fall's foamy face. Down came a sudden wind like a Sahara sandstorm, and they were trapped there . . . couldn't climb out. The pilot headed down the Gorge toward the Steel Arch Bridge, but he couldn't climb over that, either. So he scudded underneath less than ten feet above the lashing rapids. He fled under the Michigan Central railroad bridge for the same reason, with his wings wobbling piteously while Bonnick grinned and snapped the shutter in great glee, waving his arm to the

(*Continued on page* 190)

Arrangement of Instruments for Blind Flight



Three views showing blind flight instruments installed according to Stark's 1-2-3 method of flying.

THE accompanying three photographs show the proper arrangement of the Sperry and Pioneer instruments on the panel for blind-flying.

The top and right hand photos show the installation in a Curtiss Condor, while the photo at the left is an installation on a Ford tri-motor. These instruments are standard equipment on all Eastern Air Transport Lines airplanes, the panels being designed by Howard C. Stark, of that company.

The pilot uses only one of the two instrument systems at one time for maintaining level flight, either the Sperry or the Pioneer system, because of the difference in the information conveyed by the two systems. With the Sperry system, the plane is first banked by the use of the ailerons. With the Pioneer system they use the rudder first and then the ailerons because the ball indicator in the latter system is influenced by centrifugal force due to the turn.

Thus, when two separate systems are used, as on this panel, one can be used as a check against the other and thus avoid confusion. Again, by placing the panel in the window directly in front of the pilots, the natural horizon is directly comparable with the artificial horizon on the instrument during good visibility and this gives a feeling of security when the natural horizon is obscured.

Looking at the instrument in this position is as natural as looking out of the window at the real horizon, and it is also very easy to look toward the ground when breaking through the clouds.

This arrangement is particularly adapted for using "Stark's 1-2-3 Rule of Blind Flight", advanced by Stark in 1931. This definite rule, which is required by the Department of Commerce for all pilots flying on scheduled air transport lines, is as follows.

STARKS 1-2-3 ORDER OF BLIND FLIGHT

FIRST—Center the turn indicator with the rudder only.

SECOND—Center the ball-bank indicator with ailerons only.

THIRD—Center the airspeed or climb indicator with elevators only.

This rule is absolutely necessary for training pilots to regain level flight automatically, simply by reading his instruments in the above 1-2-3 order. This is practically the same thing as automatically shifting gears on an automobile, making the five necessary moves without thinking about them separately.

This definite rule is also necessary to regain level flight when the plane has passed 45 degrees—or cross control—as the plane will not recover unless the three controls are operated in Stark's 1-2-3 order.

Before this rule was established the pilot flew blind, not permitting the instruments to get off center. If rough air now caused the airplane to pass a 45 degree bank, the pilot's only recourse was to bail-out or spin-in if he had no ceiling.

This installation of dual check instruments, together with Stark's 1-2-3 method, seems to be the ultimate in blind flying safety. The comfort and easy vision of the pilot also contribute greatly to the accurate maneuvering of the ship under low visibility.

The next step will be the perfection of automatic controls that will not only stabilize the ship but which will maintain a given altitude and a predetermined course.

How to Start an Aero Club

by T-2003

PART II

Further useful and profitable information on the organization and management of amateur flying clubs.

HAVING discussed the flying club "as is," and some of them "as was," let us discuss the $10 an hour estimate. Please notice that I have so far mentioned very little about organizing the club.

The estimate of $2.25 an hour for gas and oil seems high, but one should remember that one hour flying instruction means an average of one hour and 20 minutes elapsed time, counting engine idling and necessary test flights. Nevertheless, by the use of a small airplane and a 60 h. p. engine one can get along with a rate of $1.25 an hour, —where gas costs are reasonable—and by cutting down idling to a minimum.

Hangar rent, on the basis of 300 flying hours per year, is exorbitant at the rate of $1.35 per hour. Perhaps at A1A airports near a large city a small training plane would cost $35 or so a month for storage, but a small plane should cost no more than $15 per month at the average airport.

The 300 hour year seems like a small amount of flying but an active club, flying their ship at 500 hours a year, will cut down their flying-hour rate for storage to about 45 cents. Bear in mind that a hangar need not be heated in winter, except enough to warm up the engine and airplane before it is to be flown or worked upon.

By the way, a modest hangar-garage for a small plane may be built for about $250. Investigate this opportunity to save money in the long run. At large airports, of course, the erection of such hangars is usually prohibited, but not when you're flying from a private pasture.

Mechanical service may cost nothing, if your club members are competent mechanics. When a club becomes large enough, it generally uses a mechanic from outside the club, and this appears to be the most satisfactory method.

For a small, struggling club that has its own mechanics, let us put down this charge for mechanical service as "zero," but allow a certain cost for engine overhauls and minor repairs. It seems a high rate, $50.00 for engine overhaul and minor repairs for every 50 hour's flying time. Let us say that at present rates for ship service and for a small engine that 60 cents would be more like it.

THE next item, "minor airplane repairs not covered by insurance," depends upon the care the flying members take of their ship. With a small $1500 ship, the repairs not covered by insurance would be about 90 cents per flying hour; but where a small club carried no airplane insuranee the large items of destruction must be figured in and these might boost this 90 cents up to $1.25 which we will let stand.

"Miscellaneous," we'll put at 10 cents per hour.

Once again we emphasize the necessity of working members who will really get their hands dirty.

Depreciation reserve on a very *small* ship should be figured on the basis of a new plane after 1100 flying hours, and with a $1500 ship we find that $1.35 put in the bank for each instruction hour should insure a new ship when the old one is worn out through average wear and tear. Our revised schedule then, may be—

HOURLY FLYING EXPENSE

Gas and oil	$1.25
Hangar rent	.45
Mechanical service	.00
Engine overhauls and Minor repairs	.60
Airplane repairs	1.25
Miscellaneous	.10
Depreciation reserve	1.35
Total hourly charge for use of the airplane	$5.00

Notice that I have said nothing about the use of a hired instructor—a professional pilot. This is something desirable but not always necessary if care is selected in picking out some one who will instruct without charge. At present, any number of good pilots would like to keep their "hand in" and instruct free for that privilege. Therefore, the $5.00 an hour charge seems reasonable.

SOME manufacturers of airplanes, suited for club instruction, place the figures at $3.10, others go as high as the first quoted $10.00. The $5.00 estimate of mine can certainly be lowered by using a private field and erecting your own garage-hangar, by having the use of a good shop and a good mechanic or mechanics in the club.

A YMCA or similar organization is a good place to start the ball rolling. Gather 'round you about 10 willing and enthusiastic workers—a notice on the bulletin board will do. It will seem cruel, but practical, when I say that the jobless fellow will not make a helpful club member.

Decide whether you want nothing but flying members or whether you will admit sustaining members also, such as members' friends, parents or other relatives who have no desire to fly but want to do their bit. Try to include some good mechanics.

Also try to get a lawyer. He can show his willingness to do something by drawing up articles of incorporation. All chip in $2.50 to start the ball rolling. Once incorporated, have your member who handles publicity, phone to the city editor of all local newspapers and say, "I represent the So-and-So Aero Club, Incorporated. We have organized the club to give flying instructions to our members, to boost private flying in this town. We are starting a drive for new members. To show we are not asking favors we have put a paid ad in your paper calling for prospective members. Our president's name in So-and-So, and the rest of the officers are all connected with local industries."

The subsequent newspaper notice will call attention to your ad, which might be worded this way,—

"Fly at little cost with the So-and-So Aero Club. We can take no more than 10 new members who are good workers, and who want to become pilots and part-owners of an airplane at very little cost. We investigate you and you investigate us. Address So-and-So Aero Club, address ———."

Your three member committee on membership investigates each applicant personally. The "no more than ten new members" crack is the best way to keep idle replies from cluttering up your mailbox. Take in twenty if you need to.

Your dues should be about $1.50 a month until you know what your

club-room rental, stationery, postage and other charges will come to. Explain things to the new members. When you have the makings of a new club,—decide whether you will build or buy an airplane. Look over the used-plane market in your vicinity and also your club's ability to appraise the value of a used plane. At this stage it might be a good idea to let the local editors know that you would appreciate the assistance of one or two bona fide pilots *who have their transport licenses*, to act as sponsors for your club. Do not neglect to also notify your local "Exchange Club" unit, as this club is a real booster to aviation in deeds, not words.

If you decide on a new plane, either fly-away or to build yourselves, read the ads in this magazine and send away for all the literature you can get. In building an airplane of small size, superhuman skill is not required; but half of your members should have some mechanical ability. If you buy a ship already built, either new or used, the most equitable manner of distributing ownership is by shares.

Say you have twenty members. An $1800 airplane would be about $100 investment for each of these members and each member is required to invest $100 as his initiation fee for becoming a new *flying* member. Upon the member's resignation, an applicant for membership may buy his share. Only flying members can receive instruction. Theoretically, all depreciation reserve funds on hand, plus value of plane at that instant will equal value of shares held by members.

Your lawyer member should be busy in the meantime, arranging to have the treasurer bonded against his own possible dishonesty or the dishonesty of others, as $2,000 in the treasury is bound to attract the notice of dishonest and scheming individuals. A clubroom might be "borrowed" from the YMCA, the American Legion, the Exchange Club or else use the hangar where the airplane is stored.

In *building* an airplane, it is usually best to dispense with the share system of initiation fee and assess every member for the cost of material. Remember, that in building an airplane, the cost of storage will continue for several months before any instruction can be given in the finished ship. The club could give a dance or some such social function to raise the cost of the engine, but I recommend against this.

Small shares may be taken out for the engine to enable the club to buy it outright as soon as it is needed, and these shareholders may be reimbursed by cutting the cost of instruction to them. That is,—with a built-up airplane, which would be rather inexpensive and where the proper instruction charge to members might be $3.50 an hour; $3.00 an hour could be charged these contributors until the difference has paid for their contribution, and $3.75 might be charged the other members. Don't give too large a "cut rate" as this will deplete the club funds too quickly and fail to provide for the growth of the reserve funds.

The Luke Memorial

(See inside front cover)

IN memory of Lieut Frank Luke, Jr., the "Balloon Buster," the American Legion is planning a $1,000,000 home to be erected in Phoenix, Ariz. The plaque shown above is to be mounted within the building on its completion. Phoenix, was the home town of the "Balloon Buster."

SOCIAL dues for membership should be kept separate from aviation dues, and these dues should pay for club house (but not shop or hangar) rental and for other like incidentals. Here you will find the services of an accountant, who is also a member, a great help, in fact, a lawyer and an accountant are as valuable to the club as any mechanic.

Where it is not possible to hire mechanical work done or where the club is building its airplane, all members should be required to contribute a minimum number of hours per month in doing something useful. A fine of 5c an hour for failure to furnish the required minimum was used by one club and nobody kicked.

The roster of officers of the club might read somewhat as follows:—

President — Vice-President
Secretary — Treasurer (Accountant)
Counsel — Financial Secretary
Club-pilot — Chief Mechanic
Operations Manager

The president and two of the next ranking officers appoint committees. The Club-pilot appoints his assistant. The Operations Manager keeps record of time turned over to him by the pilot. The Chief Mechanic appoints his rigger, engine foreman and line chief. The officers may be prone to "let George do it" but that indicates that the members have voted for the wrong officers.

The Club-pilot is obviously necessary. He is the instructor and club sponsor, the Dutch Uncle, who will turn out pilots from among the club members who are competent, in turn, to instruct. But this is usually a long way off.

In casting about for such a man, the sources of assistance for aero clubs previously mentioned in my first article, might find a good pilot who will be willing to instruct without charge or for only enough to pay his own insurance premiums. Do not ask headquarters in Washington for names as they are not as familiar with the *local* situation as the local Department of Commerce Inspectors, or the Army or Navy Reserve Corps headquarters.

I AM not an advertisement solicitor, but I have unbounded faith in newspaper or magazine ads — especially these days; and a well worded ad, plus a 'phone call to the newspaper's editor, should get you somebody competent to instruct. If he has held an instructor's certificate from the Dept. of Commerce in addition to his Transport license, then you may have confidence in his instructing ability. Nevertheless, ask him if he minds your investigation of his honesty and past record. If he's the right kind he'll be glad you are taking him seriously.

To the cost of flying training, which I have outlined above, must be added the cost of having this instructor. If he is a good one he will be the cause of reducing "repairs" and "depreciation reserve." The savings won't compensate for the cost of his services,—but better pilots are likely to be turned out.

When a good member-pilot is turned out, he may instruct the other club members free of charge,—although I would like to call attention to reason No. 15 why one club blew up, and warn you to be careful that reason No. 8 doesn't occur in your club.

And now we must consider the laws governing flying clubs which will be our final worry. Investigate your state laws by sending to the Superintendent of Public Documents, Washington, D. C., for Aeronautics Bulletin No. 18, "Compilation of State Laws." The price is 15 cents. This will give you the dope on amateur flying and whether you will be allowed to fly a home-built plane.

It is a very good plan to have from six to ten interested men start the ball rolling and to layout definite plans before trying to get new members. This makes it much easier to carry on.

A German Air-Yacht for Americans

This remarkable German amphibian combines the best points of American and German engineering practice and is built according to American standards, mostly with American materials and equipment.

THE HE-57 is a six-place cabin amphibian flying-boat powered with a Pratt & Whitney Wasp 425 h. p. engine mounted as a tractor in a nacelle above the hull.

It is a high wing monoplane with the lines of the cabin fairing into those of the wing. The high wing is braced to the sides of the boat hull by steel struts under each wing panel. Attached to the wing bracing, is a wing float for additional lateral stability on the water.

The landing gear is attached to the side of the boat and is raised or lowered by a simple hydraulic mechanism. For landing, additional safety is insured by an automatically self-locking mechanism below.

The cabin is exceptionally large and roomy and, if desired, another passenger or two can be comfortably carried. Duralumin and Duralplat are the chief materials used in the boat construction with some of the highly stressed parts of steel.

The plane was designed and constructed at the Ernst Heinkel Flugzeugwerke, Warnemünde, Germany, under the direction of Dr. Ernst Heinkel. An American engineer, Mr. Richard M. Mock, supervised this work at the Warnemünde factory. Thus, it can be seen that engineering information and facilities both in the United States and in Germany were available in developing a design utilizing the best features of both.

The useful and payloads of the "Heron" are exceptionally high for a single engine amphibian of its power, while the performance both in the air and on the water is commendable. Unlike most cabin planes with high engines, the longitudinal stability with or without power and with various centers of gravity is exceptionally good.

AT THE rear of the cabin is a baggage space near the entrance door while at the left side is a compartment containing a toilet and a wash stand.

The Heron was designed and built in Germany with mostly American materials and all American accessories that are apt to require minor service or replacement later. These include an American Wasp engine, Eclipse starter and generator, Exide battery, Bendix wheels and brakes, Standard Steel propeller, Parker fittings, Aero Supply pumps, valves and engine accessories, Pyrene pressure type fire extinguisher, oil-draulic oleo shock absorbers, and American Pioneer instruments.

The stress analysis and technical data were prepared in accordance with the requirements of both the U. S. Department of Commerce and the "Deutsche Versuchsanstalt für Luftfahrt" (German Aeronautic Research Laboratories, usually called the DVL). As a result, the plane far exceeds the minimum safety requirements of either set of regulations as in some ways those regulations differ greatly.

The "Heron" HE-57 Amphibian built in Germany of American materials.

In addition to the amphibian gear, which in itself is a great safety feature, the boat hull is built entirely of metal with all gasoline lines outside, and engine located so that in the case of a crash it would cause the least amount of damage.

Remote control fire extinguisher, life preservers, non-shatterable glass windows, safety belts, etc., are provided as standard equipment. In the event of an emergency, there are five possible exits from the boat.

The boat hull is divided into three watertight compartments, each separated by watertight bulkheads. The forward compartment is the hold, the middle one contains the cockpit and cabin while the rear compartment is empty and is used only to support the tail of the ship.

AT THE front of the middle compartment are two seats fitted with dual control. The control of the right side can be removed, so that either two pilots, a pilot and mechanic or pilot and passenger can be carried. The chairs are comfortably upholstered and are adjustable vertically as well as being fitted with foot rests.

The engine controls are mounted between the pilots' seats on the center window support member. At the roof of the cockpit and between the pilots are the auxiliary engine controls such as nose shutter, carburetor intake heater, engine nacelle fire extinguisher and the remote control for the gasoline valve. Also on the same assembly are mounted controls for the electrical inertia starter and booster buzzer coil.

At the left side of the cockpit, in the roof just above the pilot's line of vision, is a fitting on which is mounted all of the electrical switches, electrical fuses and other electrical controls that are necessary for use.

The control system has a single control column between the two pilots' seats and an arm that may be swung right or left in front of either seat. At the upper end of the arm is a wheel control broken into segments to provide better vision of the instrument board to the pilot.

The stabilizer is adjustable from the pilots' seat by a handwheel connected to a cable and spindle. The handwheel is mounted to the left of the pilot and is provided with an indicator to show the stabilizer setting. The rudder pedals on the left side are full plates with toe straps. The wheel brakes are operated mechanically by rotating the foot plate with the heel.

Behind the pilots' space are seats for four more people while at the rear of the cabin at one side is a small toilet and wash room. At the other side is a second baggage space and the exit ladder to the deck. In flight this ladder is carried in the cabin and fitted to the semi-fixed cabin exit ladder in such a way that it takes no additional space.

The passenger seats are like the pilots' seats in that they are of welded steel tubes comfortably upholstered with cloth corresponding to the upholstery of the cabin. Safety belts are fitted to all six chairs and in turn all six chairs are rigidly attached to the boat structure.

This chair attachment at the floor is such that the chairs can be removed

quickly with little effort and no tools. Life preservers are contained in the seat cushions and are quickly accessible by means of a Zipper fastener.

THE boat bottom is of the two step design with the second step forming a "V" in plain view which allows the use of a water rudder incorporating an oleo tail skid. In cross section, the boat has a concave "V" bottom forward of the first step and a flat "V" bottom behind raising the tail well above the water when loading or at rest.

The form of the bottom is such that the bulkhead frames of the step are mostly all alike thus simplifying the problem of jigs. Behind, the "V" angle remains the same also allowing one universal jig for all bulkheads.

The structural system consists of lateral duralumin bulkhead frames and four longerons. The diagonal loads are carried by the smooth duralplat skin. The bottom is reinforced by a keel section, being designed with a replaceable rubbing strip.

The internal structure of the boat is of dural while the skin is duralplat, a new corrossion resistant alloy developed by the Dürener Metallwerke A.-G., Düren (Germany). Dural is quite similar to Duralplat, except that Duralplat has an outside coating of a special copper-free alloy that gives the material its corrosion resisting properties.

The boat hull is built up entirely of open sections and special attention is paid that all sections and interior metal parts have been preserved properly and are accessible for further protection. All steel fittings are cadmium plated and all fittings for wings, tail surfaces, control system, engine-mount, etc., can be easily inspected.

The wing is of conventional design having box spars with spruce flanges, spruce filler blocks and webs of birch plywood. The internal drag bracing is of aluminum alloy and steel tubes arranged into a Warren truss. The ribs are of duralumin construction and are fitted with clips that permit the attachment of fabric simply to both the top and bottom flanges of the rib from the outside.

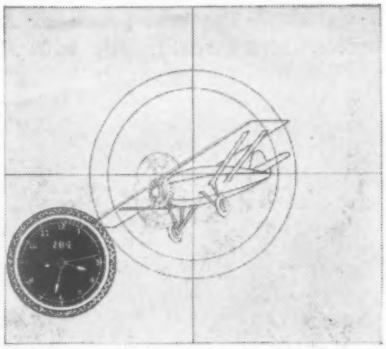
The fabric is attached by having the small clips on the ribs pierce the fabric and a thread of stainless steel wire threaded through these clips. The wire runs parallel to the flight direction and is bent over at leading and trailing edges of the wing.

The external bracing of the wings to the boat consists of streamline section steel tubes with adjustable strut ends. The fuel tanks are contained in the wings between spars and between the tanks and the boat a small tool box is built into the wing on each side.

THE structures of all the tail surfaces and ailerons are of duralumin covered with doped fabric. The fixed tail surfaces have drawn "C" section

(*Concluded on page* 197)

How the Camera Gun Records Hits



The cross-hairs are spotted square on the target.

SHOOTING with actual machine guns during combat practice is, of course, out of the question, and another means of recording hits and misses is employed—namely, the camera gun.

In this case, a specially built camera takes the place of the machine gun, but it is aimed at the "enemy" in exactly the same way that the machine gun would be handled. Instead of delivering a bullet, the camera records the accuracy of aim by photographing the location of the sights in respect to the enemy ship each time that the gun is "fired".

As shown by the accompanying picture, the point at which the two cross-hairs intersect is exactly the point at which the theoretical bullet would hit. In this case it would be a fatal hit because the point of intersection lies exactly on the cockpit of the enemy machine.

Of course, the pilot getting in a fatal shot first is the victor, and to insure that he is the first, the stop watch dial is also photographed at the instant that the exposure is made. The stop-watch photo gives an unfailing and undisputed record of victory or defeat in the case of a dispute between rival pilots.

New Design in Parachutes

AN AUSTRIAN inventor believes he has at last found a fool-proof parachute. Its principal feature consists of four light steel blades which lead from the peak of the parachute and tend, when the 'chute is closed, to open it. The parachute is kept closed by two tapes sewed to the rim of the hole in the peak and connected by a simple lock.

The taper of the lock is connected with the wearer of the parachute by a cord shorter than that which connects him with the parachute itself. The moment he jumps, therefore, the taper is drawn out by the weight of the pilot or passenger, the lock opens and the steel blades, acting as umbrella stays, spread out the parachute.

Joseph Aschner, the inventor, has tested the 'chute under many different conditions at Vienna, and pronounces it a complete success.

This and That

By T-2003

WHEN you address the Fokker Company in Holland you find that they are called the N. V. Nederlandsche Vliegtuigenfabriek (Fokker), Rodin 84 Amsterdam.

* * *

AN ability to handle sailboats well is of immense value to the lad who is learning to fly.

* * *

BROADCASTING companies invariably put their star announcers to announce aviation events, who do the job horribly in comparison with the many available lads in the flying game who do much better broadcasting when they get the chance.

* * *

ARMY flyers look on observation pilots and observers as the possible real heroes of the next war, as they will have to go out unescorted and alone, get the hot info and streak for home without stopping to fight back.

* * *

THE fiercest of all birds, the crested harpy of South America, is not used on any insignia of a service or civil flying organization. Neither is the bott fly, the fastest of all flying insects.

* * *

SOME school teachers, but only a few to be sure, use airways strip maps in teaching some forms of geography.

* * *

NEW YORK and Chicago taxi drivers rarely know the route to the Commercial Airport.

* * *

ALONG airways, during bad weather, or when the visibility is otherwise poor, you should keep to the right of the course.

* * *

ANY number of good pilots will admit having fallen asleep at the controls, at one time or another.

* * *

THE "good old flying instinct" is a lotta hooey when you're trapped in a fog. Instrument flying ability is the only thing to pull you through.

* * *

IN the movie "Hell-Divers" all scenes showing the arresting gear which slows down planes landing on the carriers' decks were deleted or carefully blocked out.

* * *

HUNDREDS of towns think they are air-marked because they were five years ago,—but the paint has meantime faded so the name of the town can't be read from the air. (Wake up, you local Aero Clubs.)

* * *

BRITISH R. A. F. pilots who have made at least 100 successful landings on the deck of an aircraft carrier are enrolled in a "club" known as the Perch Club, whose insignia is a perch (fish) complete with landing gear and tail skid. Why the perch? From the motto on the insignia—"Perchance".

XUM

Stop, Read and Think

by A. L. BREWSTER

EVER hear the story about the aviation inventor? It seems that a member of the inventive gentry made up his mind that the present specie of airplane engine eats up a lot too much gas and he decided to manufacture a gas-saving device which would decrease the fuel consumption of any known or unknown engine.

Well, he experimented and experimented, made gadjets and threw them away, stopped eating and shaving—and then—one day he leaped out of his work shop with a supercharged shout of triumph and fastened a queer looking doo-dad to the rusty motor of his moth eaten biplane.

"There!" he announced grandly to a crowd of wondering neighbors. "There is a device which will revolutionize aviation! Will it decrease the consumption of fuel 25% or 50%? No! It will decrease the consumption of fuel 150%!"

Shaking with excitement he warmed the motor until five of the eight cylinders were firing, then took off and soon proved that his device was really a success. Yes sir, his old motor actually used 150% less fuel than before. What a thrill!

What's that you say? Why aren't these gas-savers on the market now? Well you see they weren't a complete success after all. The trouble was that, with a motor saving more gas than it used, a plane equipped with one of the gas-savers had to be brought down every so often so the pilot could drain the extra fuel out of the tanks.

* * *

HAVE you stopped to think how aptly that low winged racer that won the Thompson Trophy Race at Cleveland was named? You know what a humming a bumblebee sets up, and how he can streak it? Well compare him with that GEE BEE BUMBLE-BEE that carried off the honors.

* * *

EVERY day improvements are being made in parachutes. Their weight is being cut down, they are being made more comfortable to wear, more certain to open, cheaper to buy, etc., etc. For a change, how about somebody producing a pill which swallowed by a pilot whose ship is spinning down with the controls locked and the wings about to strip off, will give said pilot courage sufficient to casually amble over the side, calmly count ten before pulling the rip cord and then languidly survey the landscape while his 'chute carries him toward a nice deep lake.

* * *

SOME similes: (1) As airworthy as a pre-war plane with loose fabric, cracked struts, six scored cylinders and frayed control wires.

(2) As safe and sane as a downwind takeoff in a 40 mile gale with a missing engine and a concrete hangar dead ahead.

Further Details of the Heinkel Monoplane

Side elevation of the Heinkel monoplane showing its long tapering fuselage.

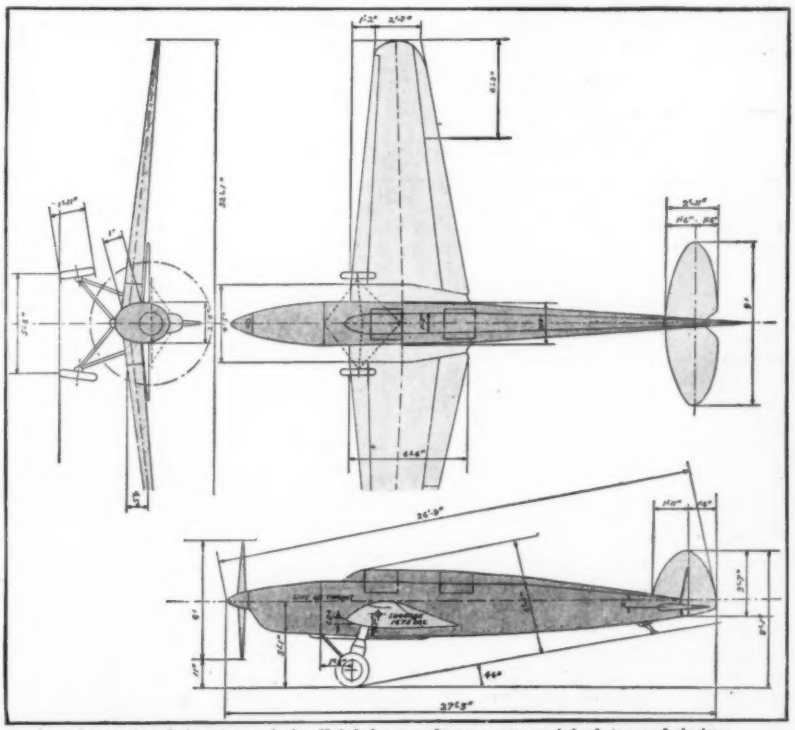
HEINKEL monoplanes were a very noticeable feature of the landscape at the European contests held last summer, both in respect to their remarkable performance and the number of the ships exhibited.

We have had so many inquiries from readers about these ships that we have decided to give a more fully detailed account of them than could be incorporated in the story "Jumping Them Off the Grass," that appeared in a recent issue of P. A. Evidently, these queries were from our scale model builders who desired to make replicas of this ship.

To begin with, it is a tapered wing monoplane of the low wing type, distinguished by its unusually long slender fuselage and the arrangement of the pilot and passenger compartments. The body design follows the open-cockpit type, but both the pilot and the passengers are protected by a very low narrow monitor or cage that just passes over their heads. Windows in the monitor give excellent visibility.

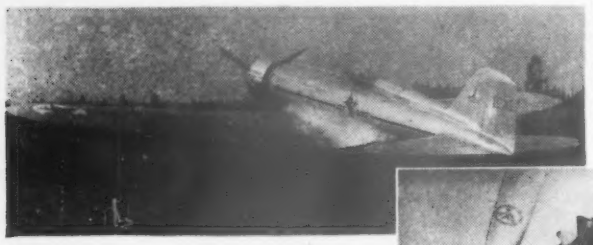
Its remarkable performance, quick takeoff, steep climb and wonderful speed range are due to the use of wing slots at the leading edge of the wing and interconnected flaps that run along the trailing edge of the wing. During the trials, this ship showed a speed range of four-to-one, a most remarkable variation. In short, if the top speed were 140 m. p. h., then it could land at 35 m. p. h. by aid of the slots.

The power-plant consists of an inverted "Gipsy" engine of the air-cooled type.



Dimensioned drawings of the Heinkel monoplane, a very original type of design.

Frank Hawks' New "Sky-Chief"



Left. The all-metal "Sky-Chief" belonging to Frank Hawks. Below. The double banked "Whirlwind" engine in the Sky Chief.

AND here we have a good look at Lieut. Comdr. Frank Hawks' new all-metal Northrop monoplane in which he hopes to establish new world's flying records.

It is interesting to note the method adopted in filleting the whole chord of the wing into the fuselage to avoid wasteful eddy currents at this point. This, alone, should greatly increase the speed over that obtained by the more usual method of leaving a gap between the body and the roots.

It is equipped with a 700 h. p., 14 cylinder, double-banked Wright Whirl wind engine, the first double-banked engine developed by the U. S. Navy engineers. It is known as the Wright G-I-R-1510.

Double banking air-cooled cylinders is nothing particularly new for it was practiced on the Gnome, R. E. P. and Anzani engines many years ago. However, this may seem novel to new comers in aviation because this method of increasing output has been laid on the shelf for a long time.

By double-banking, the power is practically doubled without increasing the diameter or nose resistance of the ship. It increases the complication to some extent as two crank-throws are employed instead of the single crank of the single row engine. The manifold connections are also more complicated, and on the whole, the method is not altogether desirable except for special conditions where an unusually compact engine is desired, as for racing.

A double banked radial engine always has an even number of cylinders while a single banked radial has an uneven number, such as five, seven or nine cylinders. In the present case, the double banked Whirlwind consists of two seven-cylinder radials mounted tandem on a double throw shaft.

Chrysler Takes to the Air

JUST to expedite service on Chrysler replacement parts, the Chrysler Parts Corporation have entered into an arrangement with the Western Air Express to make delivery by air. This reduces the time of delivery from days to hours and is therefore a great step forward toward gaining the car owner's good will.

Maybe, in the course of time, this service will be so extended that service planes will chase up stalled cars on the road and give them the necessary first-aid treatment directly. This would be service, I'm here to tell you.

Here, they're loading the plane with spare parts for Chrysler cars. This saves much time over previous methods of distribution.

Radio Effects a Rescue

A RADIO rescue in mid-air which parallels the thrilling stories of radio rescues at sea was told in recent press dispatches from San Diego, Calif., describing the plight of two Navy flyers who were stranded for hours high above the earth by fog and darkness. The two were part of a group of planes from the North Island Naval Air Station which were participating in Naval Day maneuvers when fog suddenly swept in. The others managed to land though four crashed in doing so.

The last two planes continued groping through the fog, hoping to glimpse a landmark, until Naval officials figured their gas would keep them up only 20 minutes longer.

At the request of the Navy, the United Air Lines instructed its plane dispatchers to get in touch with Transport Pilot Charles F. Sullivan who was flying in the vicinity. Talking to Pilot Sullivan over his Western Electric radio-telephone, the dispatchers directed him towards the missing planes and told him to guide them to safety before landing his passengers.

Sullivan located the planes and, blinking his landing lights, spelled out to the Navy flyers the words, "Follow me". He then guided them to the abandoned Camp Kearny airport which was ringed by hundreds of automobiles with headlights blazing. The Navy planes landed safely and the transport ship continued on its way.

Wants Glass-Bottom Planes

MANY valuable suggestions have been received from the suggestion cards which are given passengers.

Some, however, indicate travelers' lack of understanding about mechanical restrictions of airplanes. One passenger wrote: "Overnight service between Chicago and New York with Pullman berths."

A Cleveland passenger wrote: "Put windows in the floor so you can look directly down, the same idea as glass bottomed boats."

A Leap in a Cylinder

PROFESSOR Piccard's stratosphere adventures, American triple parachute leaps and endurance flights are recognized as unusual aerial feats. But one of the most curious yet conceived is that of the Danish parachute expert, John E. Tranum.

This young daredevil is making extensive preparations to leap from a plane at a height of 10,000 feet, while encased in a bullet-shaped aluminum cylinder fitted with celluloid windows. After the projectile has reached approximately 5,000 feet, the daring passenger will release himself from the cylinder and complete the descent by parachute. Tranum reports that he received his inspiration for the dramatic stunt from the late Harry Houdini.

XUM

A Revolutionary Engine Design

by HANS KUTSCHBACH
Berlin Correspondent of POPULAR AVIATION.

A most unusual solution of the valveless two-stroke cycle principle which seems to be thoroughly practical.

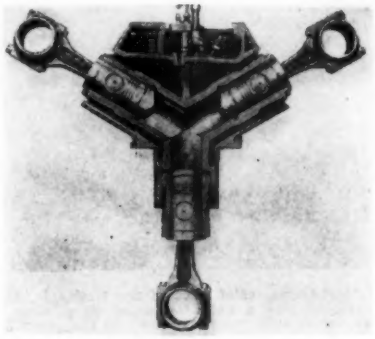
WHILE the great majority of modern gasoline and oil engines operate on the four-stroke cycle, it is well known that the two-stroke cycle engine would be by far the more desirable could certain mechanical details be solved in the two-stroke.

In the first place, there is a working stroke every revolution per cylinder with the two-stroke engine while the working strokes of the four-stroke type occur only at alternate revolutions. Thus, the same size cylinder in the two-stroke engine theoretically produces twice as much power as the four-stroke type and this is a great advantage if the mechanical details can be worked out.

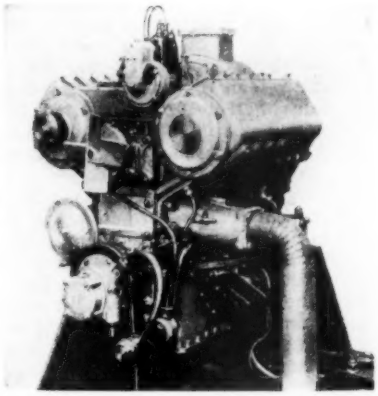
The Michelmotor Company, Hamburg, Germany, claims to have solved this old problem very satisfactorily and by simple means. These two-stroke engines develop much more power per unit of displacement than any other engine built to date, it is claimed.

This Michel engine, working on the two-stroke principle, is provided with separate scavenging pumps and the pistons are connected to three crankshafts as at (A-B-C) in the accompanying picture. It will also be seen that three cylinders are provided per unit with the inner ends of the cylinders opening into each other, a three-cylinder "star" arrangement that is the reverse of the standard radial engine grouping.

There are not any novel features in the cylinders, pistons nor crankshafts within themselves, but there is decided originality shown in the method of transferring the torque from the two upper crankshafts to the main bottom crankshaft, the latter acting as the main driving shaft of the engine. This is quite unusual and deserves special attention.



Section showing how the three cylinders open into one another at the inner end.



The completely assembled two-stroke Michel motor, ready for operation.

As shown in the longitudinal elevation, additional cranks are provided at the right-hand ends of the crankshafts and these are coupled together by the so-called "coupling triangle" which will be seen from the cross-section. The three connecting rods forming the coupling triangle have no dead centers and motion is transmitted from one crank to the other with all the certainty of gearing and yet without difficulties that attend the use of gearing. The drive for the fuel pump is shown at the top of the longitudinal section at (H) and this pump is connected to the coupling triangle.

Successive angles between the cylinder cranks are the same on all of the cylinders, but the angles between the coupling cranks and the cylinder cranks of the odd star cylinder group (next to the coupling) are not the same at all points in the revolution. They are arranged so that the lower (exhaust) crankshaft is set ahead of the two upper crankshafts. This angular setting is of great importance in regard to the scavenging process and the particular advance angle of 24 degrees is the angle that has given the best scavenging results in practice.

It is difficult to obtain effective

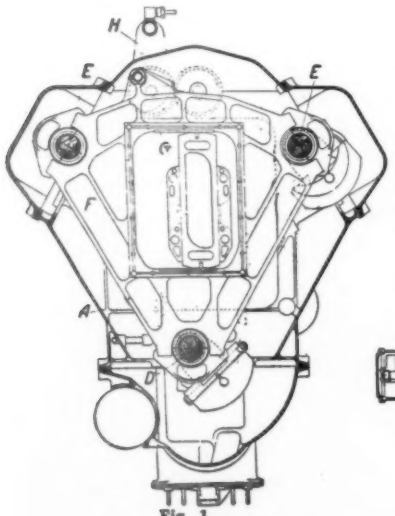


Fig. 1
The coupling triangle.

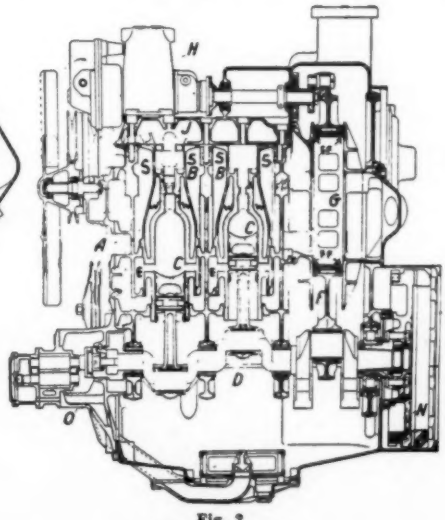


Fig. 2
Longitudinal Section

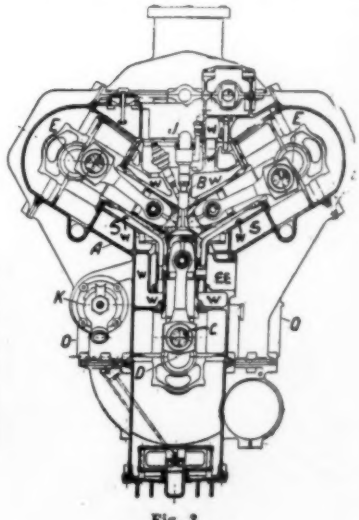


Fig. 3
Cylinder Shafts

Sectional views through the two-stroke Michel motor showing interior mechanism.

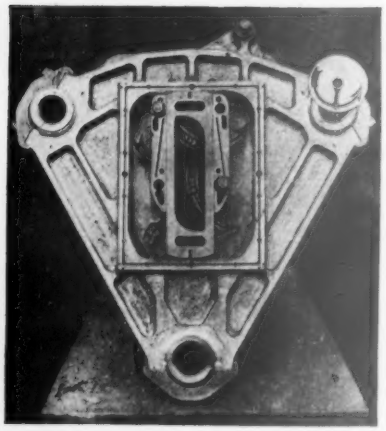
scavenging of the ordinary single-piston two-stroke engines, but in this case effective scavenging is readily obtained where two pistons enter the same combustion chamber. In the present construction, the air is delivered by the scavenging pump into the spaces (S), these spaces acting as a receiver and providing the ducts to the inlet ports.

For clearness, the exhaust ducts are marked (E-E) while the water spaces are marked (W). Since the inlet ports are opened and closed by the two upper pistons, the exhaust ports are controlled by the lower piston, the passage of the scavenging air through the cylinders being quite direct. But as the upper and lower pistons are out of phase, this enables the advantage of direct flow to be exploited still further as will be seen from the resulting cycle of operations.

It is interesting to note that there are virtually three pairs of dead centers, the inner and outer dead centers (of the upper and lower pistons) and that pair at which the volume enclosed by the three cylinders has its maximum and minimum values. At the end of the working stroke of the lower piston there is a period of 32.6 degrees during which the products of combustion are released to the atmosphere under their own pressure. At the end of this period, the inlet ports open and scavenging takes place.

This continues through 76.3 degrees, at the end of which the exhaust ports are closed by the lower piston. Beyond this point there is a further period of 15.8 degrees during which the inlet ports remain open, allowing the pressure to rise in the cylinders above that prevailing in the air receivers. In other words, there is a super-charging action which precedes the compression.

The pressure in the combustion space is greater than atmospheric at the closing of the inlet ports, thus, in addition to very efficient scavenging by the "through air", the charging of the cylinders is also brought about satisfactorily.



Showing the coupling triangle mounting which serves to synchronize the shafts.

What is the Age of a Model Builder?

Walter Adams, chief pilot of the National Air Transport, and a noted authority on aviation, has always built models even up to the present day.

ALTHOUGH model building and flying has been largely in the hands of the youngsters during the past few years, yet it was originally deemed a sport sufficiently deep and engrossing to engage the attention of men considerably above childhood's hour. This was largely due to the fact that the old-timers of 1909-1910 gravitated to building full size ships as soon as they had mastered model building and flying.

And right here, we wish to make the statement that model building and flying is in no way beneath the dignity of a full grown man and many of our male adults have discovered this fact during the last few months. We are hearing from more and more men who are taking up model building and expect to hear from many more during the next year.

And for those of you older fellows who will listen, let us say that building a good model takes just as much or many brains as playing contract bridge, golf or penny-ante. Come in and give this airplane model game a try, and we are certain that you will find it a most fascinating pursuit.

One of the most successful model builders that we know of, is well past the age of sixty. His models are the acme of precision and good workmanship. And then there are any number of men between 25 and 50 years of age who are turning to the game with eagerness. Business men, physicians, lawyers and all the whole kit-and kiboodle of trades, professions and pursuits.

And let us tell you that there is no thrill comparable with the thrill of having your first model fly away on an even keel! It well repays all of the labor and cussin' spent in building it. And for those of you who love to tinker and build things, there are but few products of the home workshop that give as much pleasure as a well finished and lifelike scale model.

Extremes!

SIX airplanes of a California National Guard Observation squadron recently enjoyed the unique experience of flying at a height (or depth) of two-hundred thirty feet below sea level! On the same flying excursion they also flew over and photographed the highest mountain in the United States, Mount Whitney, which towers 14,496 feet above sea level.

Not only did they experience extremes in altitude, but also in temperatures for, as they crossed the mountain at an altitude of 14,800 feet, their thermometers registered 10 degrees below zero. In Death Valley, which is 276 feet below sea level, a temperature of 120 degrees F. is often registered.

It was in Death Valley where the flyers, cruising along fifty feet from the bottom, made the lowest-flying record, in point of altitude, that can be made.

A New Dynamometer Test-Stand

A NEW type of transmission dynamometer has recently been developed for testing aviation engines, by the Farrel-Birmingham Company.

It does not absorb the engine power within itself, as with the Prony or electric brakes, but simply indicates the amount of power that is being absorbed by some outside mechanism. The present dynamometer has a capacity of 1,000 h. p. at 1,000 R. P. M. and can be used for higher outputs at higher speeds.

The design is based upon the principle of reaction forces between the housing and the teeth of the gears within the housing. It carries two pairs of gears arranged so that driving and driven gears are in alignment while there is a lay-shaft offset from the main shaft. The torque reaction on this lay-shaft is then easily measured from the torque arm.

By this means, it is possible to test a geared engine where the engine runs at a higher speed than the propeller, and again, either the propeller or a friction brake can be used for loading the engine.

The Farrel-Birmingham dynamometer designed for testing aviation engines.

XUM

Tips on Cross-Country Flying

by FREDERICK S. ANDREWS

Off the course and on again! Many a good pilot has got all tangled up in his bearings by his failure to observe a few simple rules. Here is how to find yourself.

"GEE, it doesn't look right, but maybe—"

And then you fly along some more hoping that some place that you really know turns up—and soon. Especially if the weather is thickening or the gas is running low. Or you are just getting along in your solo, have taken off for a few figure-eights and by the time you have lifted your little training plane to 2000 feet you discover you're over country you never saw before. And ain't *that* a helluva feeling? It's hard to say which is worse, being lost on a cross-country or on a local hop.

The reason for being lost? Lay the first to carelessness, the second to inexperience. If you find yourself? Let's hope you do it through using the bean and not through dumb luck, for in the former case you will have learned something and learning things means adding to your aerial education, sometimes without cost, which is swell.

If you're taking instruction at so much per hour, then let's hope your instructor is conscientious enough to remind you to always keep your location in mind. Most of 'em do. But suppose you've passed your tests and got P-a-couple-thousand license number and you're imbibing the art and science yourself in your own or a rented plane. What to do?

MY FIRST advice is not to get rattled. Remember, *you* aren't lost, it's your airport that has wandered away, and it's necessary to bring that airport back in sight. Don't flounder around. Fly for five minutes in one direction, turn right angles and fly for five minutes, then right turn again, and so forth, until you've flown a square course. Meanwhile look on either side carefully and thoroughly. At the same time, don't forget to look directly ahead or directly below, for many a pilot has been horribly lost while smack over his home field.

If your effective visibility is about 3 miles and your airspeed is 60 miles per hour, you will have seen everything inside your closed course, a considerable amount outside of it, and will have covered about 100 square miles with your eyes. If that doesn't fetch it, fly up into the wind for ten or fifteen minutes and start another five mile square course. Meantime, try to keep some landmark in view all the while, a gas tank, a pond or a large bright white or yellow patch on the ground. If your second attempt doesn't make it come back to that landmark—think it over.

Getting your bearings and making landings in strange country is a real problem in winter.

Let's assume you have no compass. Where's North by the sun? O. K. Now, how did you drive out to the field? Going East, on a concrete road South of a railroad? Then fly West, back to where town must be. Make it a ten minute hop. O. K. Turn and fly North and South until you hit your road South of a railroad.

If that doesn't make it, better land at the earliest opportunity and ask your way. Always keep some landmark, even if you don't know the name of it, in sight, or at least so you can find it again. Work from that landmark. By all means, do *not* try flying in an ever-widening circle as a scout would walk on the ground. In theory that's the way to find a spot, in practice the novice pilot will *not* fly a good circle nor will it be evenly spiral. The square-course system is the best in the long run.

Some words of warning and advice for the novice:

It's dangerous to "jazz" railway stations in order to read the small name plate on the end of the building. I know, or rather *I knew*, a number of lads who came to grief doing such, either tripping their wheels on obstacles ahead or pulling up too sharply and stalling after reading the name. Why haven't communities marked their names on roofs of buildings? You live around there, then why not get some action on the part of the Legion or Chamber of Commerce, or best of all, the local Exchange Club?

DON'T follow a railroad too long, for if you're only lost in a local sense there's no use going too far away from where you found yourself. Watch your gas supply. Don't be satisfied with a glance in a certain direction, but look carefully and sharply. Don't go too high—in moderately clear weather about 3500 feet is the best altitude. Be careful, but optimistic. Remember that landmark I just told you about—where is it now? And how is your gas holding out? Where is the city? Where is the airport from the city?

Look on top of every gas tank, the majority are marked. Interurban lines are often difficult to see, look sharply if you're trying to locate them. While you're following a railroad see if you can recognize having driven through any of the various under or over passes where the roads cross the railroad line.

So we'll leave the novice once more back at his home field (we hope) and turn to the pilot of more or less experience who suddenly is where he ain't while dragging it o'er hill and dale on cross-country. If it's on account of bum weather it may be inexcusable, but getting off the course in halfway decent flying is usually plain carelessness on his part.

I refrain from giving advice to the experienced pilot, except to say that if forced off the course by bad weather, which you know will soon get better, it is a wise stunt to keep entirely on one side of the course and not cross it back and forth from time to time unless you are sure you will recognize it when you are crossing it.

In other words, by drifting off to one side you know, once the weather clears up, that turning right or left will bring you back on your pre-determined course. This is better than knowing you are not far off the course but *not* knowing in what direction you are off.

Instead of further advice, let me mention instances wherein experts have gone astray, including good old T-2003 himself. No foolin'!

A LIGHTPLANE, terrifically bumpy weather, low ceiling, the compass bobbing around, I gradually bore South or to the left of my course because certain landmarks ahead were more easily visible off to the left and it was easier to hold the course on landmarks ahead even if I didn't know where these landmarks were on the map, than to fly too close to the compass. Result—I came upon a switch in a railroad that I mistook for one 40 miles further North and carelessly followed it for more miles without worrying about the compass which was bouncing all over, and finally wound up in Cortland, New York, instead of Syracuse.

Lousy weather along the pipe line which stretches in a sharp yellow line over the desert from El Paso to Midland, Texas. All the snow squalls seemed to be along the pipe line I was trying to follow. Like a siren of old, a bright spot on the horizon beckoned me off my course. Always a bright spot ahead, I followed along although

said hole-in-the-wall was changing its direction slightly but continually. Finally, a blank wall of snow cut me off and I turned tail.

Looking below I could see no sign of the pipe-line. I didn't know whether it was North or South of me. What I *did* know was that there was a railroad South of me—so South I turned, hugging this wall of snow clouds for 40 or 50 miles until I hit Toyah on the R. & P. R. R. At least I knew where I was. Falling snow had so covered the bright trail over the pipes that I could not recognize it when I passed square across it at 110 miles per hour.

Carefully following the "iron-compass" across northern Michigan, the pilot found himself boosted along by a strong tail wind. He failed to note this increasing ground speed and when he came across a spur of an abandoned logging road which did not show on his map, he took it for the main branch which was twenty miles beyond. For a moment, just at the end of this old logging railroad the lone pilot kept his course without looking at the road. Five minutes later when he *did* look down he found himself over nothing but forest. Just by luck he finally came upon a small town with an airport of sorts and was able to land and ask for his location.

DARKNESS was coming on and a pilot was quite lost in central Oklahoma, after having flown over a cloud bank for 200 miles. The clouds were now gone and he could see the ground, but the country was flooded, and although fields were numerous they were too soggy for safe landings. Several railroads and a few towns. Cushing? Chandler? Okmulgee? Nuyaka? — where was he?

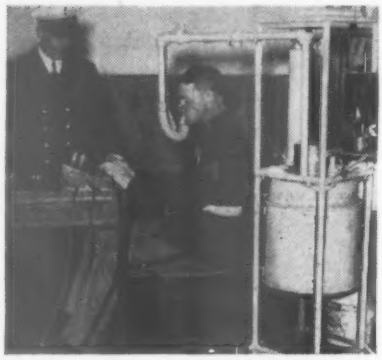
It was getting darker, but the pilot was no fool. He kept off the ground, not wishing to bog down or nose over in a wet field. Suddenly what he had been counting on happened. Lights began blinking and flashing on the ground below. On either side was a string of fixed blinkers, off to the Southeast were the lights of a city. He was up Northeast of the Canadian River and the city lights were those of Tulsa, the blinkers being on the regular Tulsa-Ponca city route.

In other words he was 55 miles north of where he had expected to be. He had failed to note the wispy tops of the clouds below him, and the fact that these "feathers" were leaning toward the North, thus indicating a Southerly wind that was pushing him along at a good rate.

Hopping West from Uniontown, Pa., to Columbus, Ohio, a pilot crossed the Ohio River at Wheeling, then followed the most apparent road from Martin's Ferry. This, however, was not the *main* highway to the West; the latter starting out in an inconspicuous manner along a little valley. The other road which veered Northerly, showed

(*Concluded on page* 197)

High Altitude Tests



Here, the prospect is undergoing a metabolic test.

THIS picture shows how the U. S. Navy tests its pilots to determine their ability for withstanding high altitudes, of course, without the oxygen equipment.

The very high altitudes affect the pilots in two ways. In the first place, the reduced air pressure increases the relative blood pressure which may, with certain people, cause bleeding of the nose or lungs, deafness or even coma. Second, there is a deficiency of oxygen (by weight) in the rare air, and this necessitates the lungs handling larger volumes of air for performing their functions.

The apparatus consists essentially of a volumetric tank for measuring the quantity of oxygen handled by the lungs under varying pressures.

Italian Maneuvers

FLYING upside down seems to be the favorite pastime of the Italian Air Corps and here we see a full squadron flying in perfect formation—every plane inverted.

This Italian preference for inverted flight was first in evidence when the Italian representatives to the 1930 National Air Races gave a wonderful exhibition of inverted stunt flying. Since that time, apparently, the science or art has been greatly improved upon by the officers.

In upside-down formation.

Aero - Sportswomen

By JOAN THOMAS

ALL but three states of the forty-eight, Nevada, Vermont, and Wyoming, have one or more women pilots. California takes the lead with 128, while New York ranks second with 73. Other states high on the list are Pennsylvania 43, Ohio 30, Illinois 26, Texas 25 and Michigan 23.

* * *

A NEW pilot's license has been issued to Osa Johnson — Mrs. Martin Johnson to audiences of the jungle picture, *Congorilla*. She had followed and photographed the trails of the jungles with her husband, so it was only natural that she should learn to fly along with him, too. Now they are all set to take a couple of amphibians along on their next trip to Africa.

* * *

URGING women to fly even before urging them to vote is quite off the line of the usual political ballyhoo in campaign speeches, but that is just what Mary Nicholson did when she made seven campaign speeches in one week during the recent campaign for her father who was running for Register of Deeds on the Republican ticket in Greensboro, N. C.—and with the full approval of her candidate, too!

* * *

MANY nationally known orchestra leaders own and even fly their own planes, but Grace Sefton (Mrs. Grace S. Meyer) of Johnstown, Pa. is the only known woman pilot who sings professionally.

* * *

GOING aloft to capture a large balloon released by a department store in an advertising stunt, Miss Annette Gibson of New York, gave spectators an unexpected thrill when she was thrown over the side of the plane as the balloon tangled in the left wing of the ship and sent it into a spin. Her foot caught in the safety belt in her seat, and Hugh Copeland, her flying companion, seized the controls and leveled the plane out just over the heads of horrified spectators. They made a safe landing at Roosevelt field.

* * *

ALTHOUGH Maryse Bastie of France was unable to better this record by an hour, she became holder of the official women's duration record of 26 hours, 47 minutes and 30 seconds, on July 28, 1929, because women's records had not been recognized as world's records.

Nearly a year later, May 3, 1930 Lena Bernstein, a Russian, who lives in Paris, broke Elinor Smith's record, as well as Maryse Bastie's, by 8 hours, 59 minutes. This was Mlle. Bernstein's fifth attempt to break the old record; 35 hours and 46 minutes remained the record until September 19, 1930, when Maryse Bastie won back the record by staying up 37 hours and 55 minutes.

XUM

Question and Answer Department

THIS department is open to all of our readers and we welcome your inquiries so long as they apply strictly to aviation. So send in your questions. This service is free to everyone, but please avoid personal matters or subjects that are not of general interest. And just as a particular favor to the editor, please *print* your name and address so that no mistake will be made in sending a reply. Every month we receive letters very indistinctly written, and sometimes the writer has omitted his name or address altogether.

All questions of general interest on any phase of aviation will be answered authoritatively by Popular Aviation's Technical Staff.

* * *

QUESTION:—F. R. S., Dayton, Ohio. *Does the body of an airplane help to lift the ship?*

Answer:—UNDER some conditions of flight it does help but under other conditions it may oppose the lift of the wings. If the upper part of the body is convex, as with some cabin jobs, it gives a pronounced lift, but if it is convex on the lower side it will pull downwards against the wings.

* * *

QUESTION:—D. K. N., Rochester, N. Y. *Has a helicopter ever flown?*

Answer:—THEY have never flown in a practical sense. They have risen to a height of about 30 feet which seems to be the limit for this type. The main difficulty is the problem of stability.

* * *

QUESTION:—F. S. A., Denver, Colo. *I understand that the travel of the pressure center on a flat plate is different than with a cambered wing. Is this true?*

Answer:—YES. The travel of the center of pressure on a flat plate is such that it always tends to hold the flat surface normal to the wind direction or flat against the wind. This is not the case with the average cambered surface.

* * *

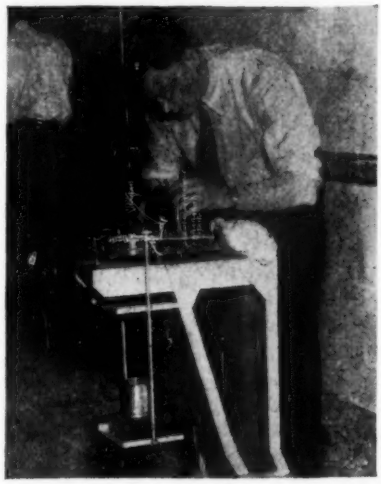
QUESTION:—G. G. McM., Phoenix, Ariz. *What is the best wing section?*

Answer:—THERE is no one wing section that covers all conditions. It depends upon how the wing is to be used. Some wings are highly effective for lifting but create too much drag. Other wings have good lifting qualities and require little power, but are too thin to allow the use of sufficiently strong wing-beams, and so on.

* * *

QUESTION:—D. F. C., St. Joe, Mich. *Would an airplane fly faster if the wings and fuselage were oiled or greased?*

Answer:—THE improvement, if any, would be very slight. There is very little loss due to the air rubbing along the surfaces. This loss is extremely small when compared to the losses caused by turbulence or the air eddies set up in the air.



Measuring the lift and drag in a wind-tunnel.

* * *

QUESTION:—R. F. D., Franklin, Pa. *What causes a glider to fly?*

Answer:—THE force of gravity or the weight propels the glider just as it propels a body sliding down hill.

* * *

QUESTION:—G. G. S., Cedar Rapids, Iowa. *Does the quality of the lubricating oil affect the compression of an engine?*

Answer:—YES. If the oil thins out too much, the compressed gases will blow back past the piston rings.

* * *

QUESTION:—J. S. E., Minneapolis, Minn. (*a*) *What is the compression ratio of an engine?* (*b*) *What does the octane number of a gasoline indicate?*

Answer:—(a) THE compression ratio is the relation of the total volume of the cylinder to the volume of the clearance space at the end of the piston stroke. This will vary from 5.0 to 9.0. (b) The octane number indicates the ability of the gasoline to resist detonation or explosion waves at high compression pressures. Because of their high compression pressure, aviation engines require gasolines of high octane number.

* * *

QUESTION:—J. E. T., Riverside, Calif. *Can an airplane engine be muffled to reduce the noise?*

Answer:—YES, it can be muffled like an automobile engine, but this only does away with a small part of the total noise. The propeller is also an offender.

* * *

QUESTION:—H. H. K., Atlanta, Ga. *What is the difference between compression and tension members in respect to their size? The compression members always seem larger than the tension members.*

Answer:—THE tension members prevent two bodies from pulling apart and this tension stress is the only force acting on them. Compression members prevent bodies coming together, and in addition to the compressive stress there is a bending action that calls for still more material.

* * *

QUESTION:—D. S. A., Jackson, Fla. *What is meant by "direct lift aircraft?" Please give a few examples.*

Answer:—A DIRECT-LIFT ship covers the helicopter, autogiro, some ornithopters, the dirigible and the balloon. In short, such devices can lift straight up instead of being compelled to move horizontally as with the airplane.

* * *

QUESTION:—A. F. G., New Orleans, La. *What are the incidence wires?*

Answer:—THEY are the cross-bracing of a biplane that run between the front and rear struts. They maintain the incidence angle of the wings and keep them from twisting.

* * *

QUESTION:—T. A. S., Eau Claire, Wis. *What is efficiency and how is the efficiency of an aviation engine expressed?*

Answer:—THE "efficiency" of a machine is the ratio of the work done by the machine to the energy supplied to it in the way of fuel, etc. In the aviation engine, the efficiency is the ratio of the power produced by the engine and delivered to the propeller to the energy supplied by the gasoline in the form of heat energy.

* * *

QUESTION:—E. R. T., Portland, Me. *Is a monoplane much superior to a biplane and if so, why it is better?*

Answer:—AS ordinarily built, a monoplane requires less power than a biplane of the same size, weight and speed. On the other hand, the biplane is more compact, can be made stronger for the same weight and can be made more stable and maneuverable.

* * *

QUESTION:—L. B. N., Tulsa, Okla. *What is meant by the "size factor?"*

(Concluded on page 189)

My Experience in High Altitude Photography

By Master Sergeant Andrew E. Matos

RECENTLY, I accompanied 1st Lieut. David W. Goodrich, Army Air Corps, on an experimental flight to determine the ceiling of a Fairchild photographic airplane, also to obtain photographs showing the Capitol, the new Mt. Vernon Boulevard and Mt. Vernon itself, 22 miles away.

The visibility from the photographic standpoint was fair. A service camera was used with a filter and super-sensitized speed film. At 11:30 a.m., when we left the ground, the temperature was 38 degrees, and it fell to about 15 degrees below zero when we reached an altitude of 23,200 feet, at about 2:30 p.m.

The first 10,000 feet was made in 15 minutes, but it took 45 minutes of hard struggling to make the last 500 feet. Breathing oxygen from an ice-cold tank was like eating ice. The camera was frozen and very hard to operate.

The exposures were made about 2:30 p.m. This was late for the time of year and the negatives were rather flat, somewhat under contrast. The results obtained, however, were very satisfactory. Six vertical photographs were made at three-minute intervals and, according to the overlap on photographs, the ship was making very little headway. There was a 90% overlap. We estimated that a 70 to 80-mile head wind was blowing.

One of the greatest difficulties encountered in taking the photographs was the short length of tubing connected to my oxygen tank. It was less than a yard long, and it was almost impossible to move from the back of the plane to the front in taking obliques and verticals. It was also difficult to keep the mouthpiece from slipping out due to the excessive chattering of my teeth from the intense cold.

When making the last strip of photographs over the main part of the city, the left gasoline tank went dry and the engine stopped roaring. For the moment I forgot my camera and turned my eyes toward the front of the plane.

Usually in such cases Lieut. Goodrich's movements are very quick, but to my surprise he seemed to be moving very slowly. Apparently his vitality was lowered by the rarefied atmosphere. He succeeded in pulling the throttle back, but it took both of his hands to turn the switch to the center tank. The engine started roaring again, and another photograph was made which, when compared with the others in scale, showed we had lost 2,000 feet altitude in those few seconds —quite in contrast to the hard struggle we had undergone to gain the last 500 feet.

After being in the air three hours, my supply of oxygen was nearly ex-

(*Concluded on page* 188)

Balchen Has a Variable Pitch Prop

Note the electric motor projection through prop hub.

HERE we have a close-up of Bernt Balchen inspecting the new variable or controllable pitch propeller that has been fitted to the plane in which he intends to explore the South Polar regions.

It will be noted that this picture shows the installation of the propeller described in the September issue of POPULAR AVIATION, an article that described its features in detail. This is an electrical device (electrical motor projecting out of hub) that is controlled from the cockpit.

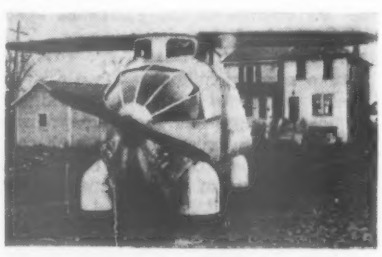
The pitch is reduced for the take-off when the greatest amount of thrust is required at low plane speeds, and then is increased when in flight so that the proper relation is maintained between the flying speed and rotational speed. The engine is a high compression Wasp provided with a super-charger.

Well, of All Things!

NOW just take a quick look and close your eyes. Can you visualize anything that rhymes with this picture? No, it isn't a streptosaurus and it ain't a rhinoceros. It's just a freak plane from Europe.

Its four landing wheels give us the quadruped atmosphere, while the pilot house on top of the ensemble is quite too elusive for us. Monsieur de Richmond, accused of this sheet iron lizard, certainly overlooked a lot of things when he attached the ten foot wing intended to carry about a ton of weight.

And the frontal area is about 20 square feet.



Here's the most unusual plane we have seen.

Photo Phans Club

WELL, Phans, this notice may win your approval, at least we hope that it will. In short, we are going to return to the old form and print notes on all of the membership under one head instead of running the names and swaps in the Barter and Exchange Department as at present.

We have had a great many letters requesting us to return to the personal club notes in the original form. On the other hand, we have had kicks from the lightplaners who rather resented sharing the B & E columns with anyone else. And so, you will have your column intact and the lightplaners will be by themselves in our next issue.

So fire away, fellows, and write us the sort of notices that you used to send in, how many photos you have in your collection, what you are doing with them and what you expect to do next. And if you have stuff to swap, don't be bashful in announcing the fact.

This calls to mind a request that we had about a week ago from one of our ardent Phans. He thought it would be a good stunt if we ran an article on how to make your albums attractive and how to get the most enjoyment out of your collections. Well, we don't know of any better authorities on this subject than you fellows, so we will be waiting for a short article on how to doll up the albums and files or how to do something else with the photo museum.

And just here is where J. B. R., of POPULAR AVIATION, would like to put in a word or two. He wishes to state that he began his collection of airplane data in 1909 and has continued it over a period of 24 years. If he hasn't the largest collection, he is willing to take a bet that it is the oldest, anyway.

His collection fills three drawers of a filing cabinet and he hasn't got the courage to start counting them. Among the most prized of these pictures is a snap-shot of Herring making the first glide in the first Chanute glider, Sand Dunes, Indiana. Next in interest is the take-off of the tractor plane designed and built by J. B. Rathbun, himself, which he believes is the first, or one of the first tractor types to fly. Date: September 21, 1909.

Planes for Arctic Transportation

THE Soviet government, in an effort to open the Arctic region for airplane transportation, is planning a scouting flight to Port Igarka, a remote village on the Karsky sea.

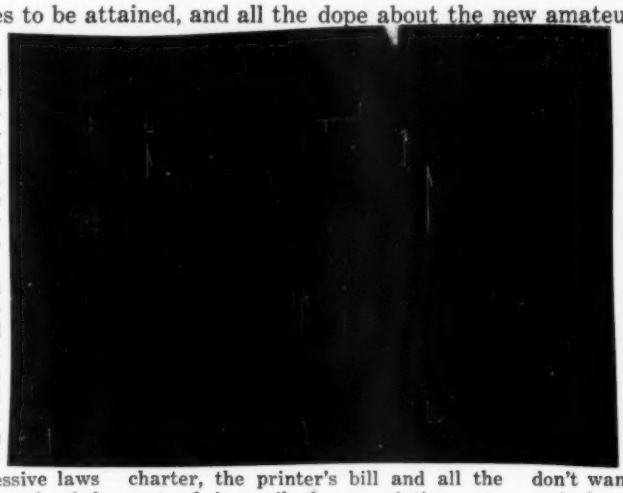
The tri-motored all-metal monoplane will be flown by Boris Chuknovsky, who gained fame by flying to the rescue of the Nobile expedition.

The purpose of the 2,000-mile trip is to map out winter routes and spot suitable landing places in the Arctic area.

XUM

Shall We Form the L. A. A.?

Now is the time for you to rally to the support of the proposed lightplane association. Here are the objectives to be attained, and all the dope about the new amateur association.



BROTHER HOWLERS, greetings! We have been successful in assembling our first temporary committee for the proposed lightplane association. It consists essentially of the men named in the February issue with only one or two exceptions.

And thus, the old Howl Department will give way to a newer department that will be devoted to the activities of the association and its membership. The old Howl Department has served its purpose well in calling the attention of our air-minded friends to the various oppressive laws and ordinances that have been leveled against the interests of amateurs and experimenters. By inches, this will be welded into the Department known as "What Our Readers Are Building," and then we will have a surpassing lightplane section full of interest and value to our amateurs.

Of course, as with the organization of any association of this class, we have many vexatious questions facing us that will require your assistance. The good old committee, when they get down to work, will propose remedies for these difficulties and it's up to you whether they will be accepted or not.

Now that the committee is assembled, we will begin to solicit membership. Before we go much farther, it will be necessary for us to know approximately how many can be depended upon for membership so that we can make the necessary adjustments for the organization. We would like to know whether our membership will be one-thousand or ten-thousand and just what we can expect in the way of support—physical, moral and financial. Let it be said that this is one of that sort of an organization that calls for a maximum of physical and moral support and an absolute minimum of financial burdens.

As we see the matter now, there will be two grades of membership, the ACTIVE member who owns a lightplane or glider or who is actively engaged in amateur aviation. The ASSOCIATE members, the second group, will be composed of those who are simply interested in amateur aviation or who wish to be of assistance to the organization and who will give it their support.

Now, to begin with, POPULAR AVIATION will pay all of the preliminary expenses of the organization, such as the attorney's fee, the cost of the charter, the printer's bill and all the rest of it until the association gets on its feet and is strong enough to look out for itself. However, before we go to all this trouble and expense we wish to be assured that a sufficient number of members will be enrolled to make it worth while, and we do not see just how the association can expect to function effectively with less than 500 members.

There should certainly be 500 lightplane fans who are interested sufficiently in this movement to do a little work for the cause and pay a modest membership fee. We have had a lot of correspondence from howlers, now let us see whether you can do something beside howling.

It has been our experience with other organizations that it is necessary to have the members pay dues in order to hold the group together until the association begins to function and starts to show results. Unless they are tied to the organization by something more definite and exacting than a promise to hold their membership, then they are likely to fall by the wayside during the rather tedious and dreary preliminaries. And this sort of member is just what we don't want.

And so, to insure that our applicants stick to the job and do something more than write indignant letters, we will ask them to remit the sum of $1.00 for one year's dues with their application. This, we believe, is only fair to the organization and to their own interests. If a prospective member is not sufficiently interested in amateur aviation progress to invest $1.00, with a hope of having the obstructions cleared away, then he is not very greatly interested.

Now please note particularly that POPULAR AVIATION will pay all of the preliminary expenses of organization,

HERE ARE THE OBJECTIVES OF THE L. A. A.

It is the purpose of this association to—

1. Oppose present restrictive aircraft legislation insofar as it affects the activities and pursuits of the amateur glider, lightplane builder and pilot.

2. Act as a clearing-house for ideas, inventions and designs of experimenters and builders, assisting so far as possible, the builders of lightplanes and gliders.

3. Promote greater activity in amateur aviation and gliding by giving the sport greater publicity and support.

4. Promote and sponsor lightplane and glider meets, races and contests, thus serving the purpose of the amateur flyer and the industry connected with amateur aviation.

5. Represent the interests of the amateur flyers and home-builders at the various meetings held by the Department of Commerce and state aeronautical commissions.

6. To establish standards in materials, accessories and supplies and if possible, to test out the various items of equipment offered on the market.

7. Cooperate with the manufacturer, homebuilder, dealer and flyer in such a way that the interests of the industry are best advanced.

8. To prepare drawings and data for the guidance of home-builders and to act as a board of inspection for their completed plane or glider.

9. Provide competent test pilots for test hopping a new plane or glider and to act as a check upon state or government inspections and tests.

10. Act as a clearing house for members who wish to sell or trade their surplus flying equipment.

11. Furnish information and addresses of dealers and source of supply of materials and equipment.

12. Act as a mailing address for members.

and that not a dollar of the contributed dues will be touched until we obtain a charter. This money will be set aside intact as a special fund until the club starts functioning, and then this money will be turned over to the chartered organization with our compliments. It will be a nest-egg for the organization when it is once running under its own power.

However, should we not be successful in enrolling 500 charter members, or should we be unable to obtain a charter, for some other reason, then we will abandon the attempt and the $1.00 due returned to each and every co Either the organization is cons or you will get your money b we do not believe it worth w to all the work and expense izing unless there are 500 who are interested enough tribute $1.00 to the movemen

We are endeavoring to make this organization useful and to accomplish anything requires a certain amount of money. After the group gets down to work, there'll be certain expenses such as stationery, stenographer's salary, the expense of printing and postage stamps, etc. All of the committee agree to contribute their services gratis for the first year, and the staff of POPULAR AVIATION will not charge for their services at any time, so the cost of administration will be nothing for the first year at least. Thus, the expense of operation will be cut down to an absolute minimum with correspondingly low dues.

And now for the purpose, objectives and ideals of this association which are given in brief by the accompanying chart. They are a compilation of suggestions by several of our committee, Leslie Long, Harold Tubbs, Lawrence Lesh and others. These, of course, are tentative and are subject to modification or elimination by the committee when it is once in action. The most important fact to note is that we have other tasks on our hands beside the simple matter of adverse legislation. In short, the organization offers a complete service to the amateur that should fill his every need.

After thinking these matters over, our next problem is a suitable name for the association. It must be expressive of the purpose, concise and easily remembered. We started out experimentally with the name, "Lightplane Association of America," but there were several objections to this name. Some wanted the name "Sportsman" introduced, while others objected on the grounds that the glider was ignored. Still others believed that the word "Amateur" should be introduced and that "lightplane" should be cut out, because the membership should cover all amateurs and private owners of a 15 h. p. powered glider, and in such event should become eligible for membership. Just think this over carefully, for many owners of high powered factory built ships have protested against being excluded from membership.

One or two of these correspondents state that they were originally lightplane builders and owners, but that they took on larger factory-made ships simply to avoid trouble with the state authorities. They state further that they are just as anxious to battle these fool laws as is an amateur with a brand new flivver plane or glider. Frankly, we do not see why a member should have a horsepower rating and advise their admission.

And now it is up to you to write us immediately just how you stand on the matter of membership and on the subjects discussed. Get out the old pen, paper, envelope and three-cent stamp and get busy this minute. Remember that we have a quota of 500 members to fill before we get to rolling, and it is just one of those things that cannot be postponed indefinitely. And while you're at it, just tell us whether you intend coming to Chicago this summer and whether you think a lightplane convention in Chicago will be feasible.

If you will come in sufficient numbers, we'll rent a hall and hold a regular pow-wow over the situation. We believe that this get-together will be of great advantage to any and all of the lightplane and glider bunch. Things can be thrashed out, face-to-face that would be difficult via the pen and pencil route.

And again. Don't forget to send that letter tonight, enclosing a money order for $1.00 if you wish to become a member. If we fail to organize, the dues will be returned to you. Make sure that all your friends join also.

The New S-66 Marchetti Seaplane

AFTER the Transatlantic flight from Africa to Brazil of twelve flying boats under the command of General Italo Balbo in 1930, Signor Marchetti, the designer of the craft, was immediately commissioned to design a new heavy duty flying boat.

Included were improvements, the result of lessons learned during the flight. The process involved two years work, every feature of the de ng submitted to exhaustive the new model was only com n the day before the opening aris air show.

ew Italian seaplane is based heory that a heavy duty flying uld be a boat first and an air- fterward. Signor Marchetti claims that most of the accidents in which this type of craft are involved are due to their lack of sea-worthy qualities rather than aerodynamic faults.

In pursuit of sea-worthiness, the new machine, the S-66, was submitted to one of the most comprehensive series of tests ever undertaken, including a prolonged period of exposure to sea-weather, when moored off Genoa harbor. In the final test, one of the new machines was taxied along the surface for 200 miles in the open sea before her engines were opened out to full power and she was taken off to make the long return trip in the air.

The most striking change from the design of the S-55s, which flew the Atlantic, is in the number and placing of the motors. Instead of two 800 h. p. engines, arranged in tandem and turning three bladed propellers, the S-66 has three motors side-by-side, operating 4-bladed propellers. By this arrangement, it has been possible to place the propellers above the wing and at the rear, thus offering them complete protection from the flying spray which damaged the propellers of the transatlantic machines. The arrangement also permits of improvements in the engine cooling systems.

The tail assembly, which is borne on outriggers from the two hulls, also represents an improvement on the S-55 design. In order to take full advantage of the slip-stream from the three propellers, thus making for easy steering, the vertical rudder is triple—one element behind each motor. Flyers who have handled the new machine claim this arrangement a great success, declaring that the big boat handles almost as easily as a lightplane.

Considerable study has also been devoted to keeping the most sensitive portions of the seaplane, the wings and tail surfaces, at a good height above the water.

XUM

Pointers on Light Plane Design

by V. W. PAYNE

The author, well known to our lightplane fans, gives some very useful advice to amateurs who are designing their own planes.

MANY of you who read about my California Lightplane in last October's issue of P. A., have probably looked for more dope on it. Well here it is. First of all, you remember my address was San Francisco, California, but I moved east to La Grange, Ill., where I am building another small ship.

The monoplane pictured in the October issue had a split type landing gear, similar to that used by the Cessna Monoplane. The shock-absorber is in the bottom center of the fuselage. The new ship has a new type Mono-strut type landing gear, and the shock-absorber goes through the side of the fuselage.

While this type of landing gear appears as a mono-strut, when the aluminum fairing is bolted on, it is really made of three struts, as you will see when the aluminum fairings (pants) are removed. As the three struts are close together, to allow the fairing to be small, these struts are heavier in cross-section than those in the original ship.

The original ship was crowded with two persons in it, if you tried to use dual controls. Well, we have left out one set of controls when we flew. The new ship has two large cock-pits and dual controls you can use.

We changed the shape of the tail surface a little, and made a larger fin, for a monocoque fuselage requires more. The ordinary square fuselage has flat sides that act like fins and hold the ship's tail from dropping when in a steep spiral. A round fuselage will gradually let its tail drop when the spiral is prolonged and more and more rudder must be used to hold it.

I'll try to give you a few ideas of the line of thought we used in first selecting this type of ship and this type of construction. I've studied many designs in the past that have been offered to the public, including many of Ed. Heath's, I also worked with him on a few. I found the popular choice was the high wing mono, or the "parasol type." We selected the parasol type, for its easy and stable flying qualities.

An old time flyer told us that the best ship for the public was one that would not fall off into a spin from a stalled position, or that could be held in a stall and would only mush down and forward, while under perfect control in this position. Well, we did it, believe it or not. How? Listen or rather read!

We wanted a ship to weigh 875 lbs. fully loaded and a span of about 32 feet, so we made the chord 5 feet,

The original Payne lightship that proved so stable and successful.

which with the tapered tips gave about 132 sq. ft. of lifting surface. The tapered tip is more expensive to build, but is very efficient, which means less drag, and less power to pull it through the air. You'd be surprised, how much drag and loss is tagging along with a square wing tip.

The tapered wing, raked forward a sort of negative rake takes off some of the strain from the tip of the rear spar which is weaker than the front spar. To give very good aileron control, 10 per cent of the wing area should be used, but we made it a good 13 per cent. That is why we can rock the ship when in a stalled position.

To give good control at the tail surfaces, a tail length, measured from the Center of Gravity (C. G.) to the rudder post, should be at least two and one half times the chord of the wing. Training ships often have three times the chord for a tail length. Ours is two and one-half times the largest chord. The total fuselage overall length is 20 feet 2 inches, with the Continental A-40 engine. This length of tail helps in taxying straight. A short fuselage, with wide landing gear, will ground loop easily.

FOR a ship with slow landing speed or low stall speed, we need fair size tail surfaces. Usually the total vertical tail surfaces are one-half the total horizontal tail surfaces, and the horizontal tail surfaces are one-sixth of the total main wing area. For example: if the wing area is 135 square feet, the horizontal tail area is one-sixth of 135 or 22½ sq. ft, area. The area of the vertical tail surfaces will be about 11 sq. ft. A square fuselage can use less vertical fin area, making the total vertical surface of about 10 sq. ft.

If you study several of the small ships on the market, you will find their control surfaces are small, all right for flying speed, but how about a stall or a prolonged spin? I could tell of many who had to jump from small planes because they could not get it out of a spin.

The next thing that was neglected in lightplanes was the parasite resistance. That is, the resistance offered by all the parts of the ship which did not give lift. Many thought because the ship was slow, they could have as many wires or struts as a war time Jenny and just as bad a shaped fuselage. The lightplane has only a small amount of power, so we must economize and cut down all the excess resistance.

We decided on a plywood semi-monocoque fuselage for it has the least resistance, has more room in it, and is the strongest and lightest type of fuselage, just suited for our needs. It is easy to repair also.

Most fuselages are square with a lot of fairing built on with an attempt to make it sort of round.

This all adds weight and makes the fuselage large on the outside, but no more room inside. The monocoque has its strength in its skin as well as the fairing, having the inside with plenty of room and easily inspected.

Now a word about balance and rigging. Take notice of how many light ships are built without thought as to the angle of incidence of the horizontal tail surfaces with respect to the wings. In other words, most amateurs put the horizontal tail surfaces, flat on the top longerons, which are supposed to be level when in flying position.

It seems that they entirely disregard the angle of down wash from the main

(*Concluded on page* 194)

What Our Readers Are Building

A department devoted to our readers' activities in airplane, glider and engine construction, showing the latest developments.

What About Monocoque Bodies?

AS YOU probably know, a monocoque fuselage is built up in the form of a thin shell without important internal bracing members of any kind.

This shell has been made of various materials, plywood, multi-layers of thin hardwood, sheet Dural, sheet steel, papier-mache', etc. It is very simple, strong for its weight and gives a remarkably smooth good looking appearance when carefully laid out. It is at once the structure, the covering and the fairing of the body.

About the years 1915 to 1920 there was a tendency toward the use of monocoque bodies by the builders of lightplanes, but owing to the poor plywood of that period and the inferior grades of glue then on the market, the practice was gradually given up in spite of its many favorable points.

Now, there seems to be no reason why lightplane builders should not return to monocoque bodies, for there are now many suitable materials available such as casein glue, albumin glue, Haskelite, waterproof veneers, sheet Dural, etc. There is no doubt but what such construction would be well worth while on the scores of simplicity and safety.

What Wing Section is Used

FROM data compiled at P. A.'s office it would seem that the Clark "Y" wing section leads all other sections by a large margin on amateur built lightplanes. In short, 67 per cent of the lightplanes on our list use this section while 22 per cent employ modified sections that vary from the Clark section by the use of deeper wing spars which increase the thickness toward the trailing edge.

Over 80 per cent of the wing sections used with gliders are Gottingen sections of some sort with the old 438 in the lead. It seems rather strange that there has not been more general adoption of the double convex wings on lightplanes, when they are so popular on other craft, both heavy duty planes and gliders.

The New Ford Engines

AFTER a careful investigation, B. H. Pietenpol claims that the new Ford engines are not as suitable for conversion into aeronautic engines as the old Model "A".

While the new "V-8" eight cylinder engine would seem to be ideal for this purpose, Mr. Pietenpol claims that it is too heavy for the power that it develops. To reduce this weight to normal requires far too much work and expense.

Scimore Has Built Neat Ship

Scimore's ship is all dolled up with a wonderful paint job and is a keen looking crate. However, it is just another victim of the N. Y. authorities.

AT FIRST glance, this monoplane gives the impression of an Italian stunt ship because of its brilliant striping and color contrasts.

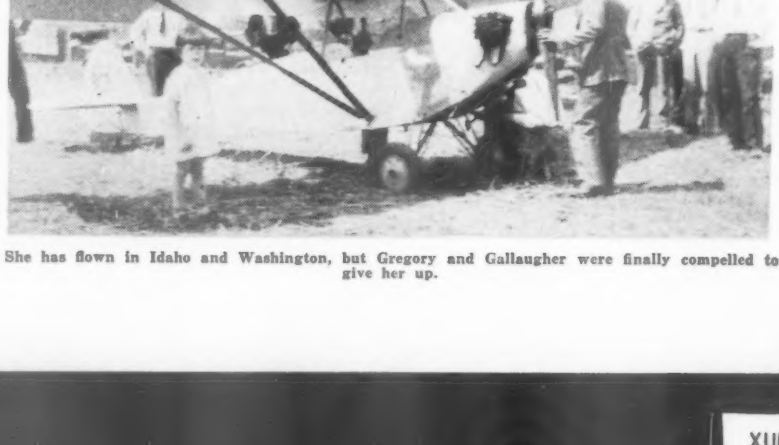
As a matter of fact, it is a homemade monoplane built by James Scimore, 30 N. Portland Ave., Brooklyn, N. Y. He says, that he built every bit of it, except for the engine, and he is to be commended for a very neat looking job. To judge from the tone of his letter, he is up against the stringent New York anti-aircraft laws.

Out of Idaho Into Washington

HERE'S another tale of whoa. Gregory and Gallaugher, Lewiston, Idaho, spent a year and a half building a monoplane, powered with a Continental A-40 engine. The ship flew splendidly but not fast enough to avoid an Idaho state inspector who caught and grounded them. They were ordered not to fly it in Idaho again.

And, just for that, the two boys moved across the river into the State of Washington where they put in many happy hours learning to fly. They were hopping over the sacks of grain and barb-wire fences one day when another shock arrived.

It was a Washington State Inspector this time with a "Hey, fellers, ya gotta get out o' this state with that homemade wind buggy." And now, Gallaugher and Gregory have run plumb out of states. Washington is pretty wide in one direction while Idaho is wide in another. They would have to move to Siam if they wished to keep on flying their little pet.



She has flown in Idaho and Washington, but Gregory and Gallaugher were finally compelled to give her up.

Lightplane Resistance Factors

LOOKING over a lot of lightplane photos, dating from 1920 to 1933, it is apparent that the lightplane builder has seldom regarded parasitic resistance seriously.

On the contrary, he seems to have hung about everything in the airstream that is possible, with all sorts of exposed bracing, complicated external landing gear struts and braces and indifferently shaped bodies and cowls. And notwithstanding these drawbacks, he has attained quite remarkable performance with a very small amount of power. Why is it?

The answer is quite simple. At the low speeds attained by the majority of lightplanes, the resistance of the structural members, however numerous, is quite low. At speeds of 90 m. p. h. and above, the resistance picks up quite rapidly and the average lightplane design would quickly become prohibitive with a more powerful engine at higher speeds.

The resistance increases as the square of the speed, hence at 80 m. p. h. we would have: 80 x 80 = 6,400. Increasing this speed to 100 m. p. h., or only 20 m. p. h. faster, we will have: 100 x 100 = 10,000. In other words, flight at 100 m. p. h. would entail about 80 per cent greater resistance than at 80 m. p. h. Running the speed up to 120 m. p. h., or 50 per cent higher speed, would cause more than twice as much resistance as at 80 m. p. h. This is the reason why many a lightplane has got away with murder at 60-75 m. p. h. that would hardly be able to waddle at 90 m. p. h.

But this is no argument for carelessness in designing a ship for efficiency. Every little bit of parasitic resistance that is shaved off the ship, means just a little more reserve horsepower, fractional h. p. perhaps, but still some reserve. Therefore, we should clean up the ship as much as possible for we may need that fraction in an emergency.

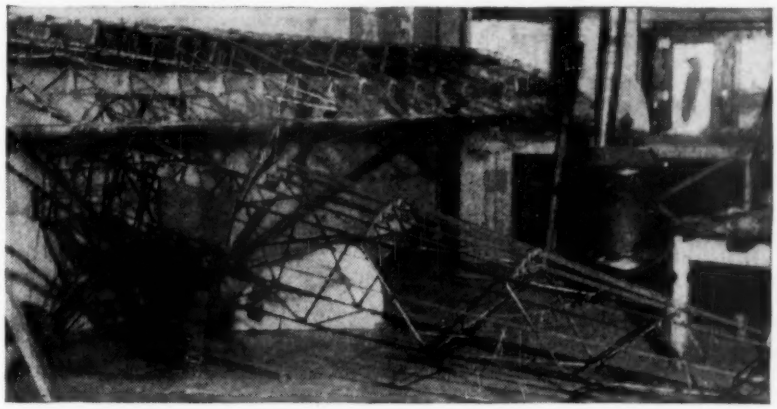
Amateur Planes Are Sturdy

IN SPITE of the carefully nurtured belief by the layman that amateur planes are unsafe and "death traps," statistics show that comparatively few fatal accidents occur in amateur flying. Most of the accidents occur with the big stuff, transports and the like.

Now, when we stop to think of it, this is perfectly natural for the reason that the great majority of amateurs fly only in good weather. They are not forced to fly through storms to maintain a schedule as do the commercial pilots of the airlines, and therefore, one danger factor is missing.

Storms, rather than structural failures, are the principal causes of accidents, and in fairly calm weather, the average homebuilt ship is quite safe.

Builds Ship—and Then Crashes



This is the Heath that Arnie Pederson built, shown during the construction stages. Arnie had hard luck later but that's another story, and it was not the fault of the ship.

HERE we have good and bad news mixed. Arnie Pederson, New Effington, S. Dak., built a Heath out of raw materials and did the job all by himself. It flew very well. One windy day, when he was just taking-off, a piece of solder got into the gasoline line and he had a crash. The ship was damaged but Arnie says nothing about his own condition. 'Stoo bad.

Well, Here's a Good Story—and Ship

Milford Langland's Pietenpol "Air-Camper," powered with a converted Ford engine, that turned out to be one sweet flying job. This is Langland's second ship.

MILFORD LANGLAND, Jackson, Minn., has built the Ford engined Pietenpol "Camper" shown herewith. He sends us a picture of both the ship and the power-plant, both of which are interesting to the amateur. Here's what he has to say:

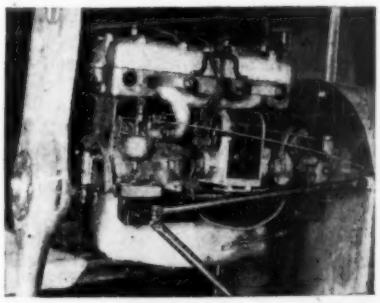
I am sending a shot of the ship I built, along with a shot of the motor that I powered it with. It is a two-place Pietenpol Camper, while the motor is none other than the mainspring of an old Henry.

The ship was flown in August and it turned out to be the nicest flying job I've ever flown. The converted Model "T" has snap if you do the things we did to it. All there is left of the "T" in this ship is the block and the head.

We raised her compression ratio, installed Dodge aluminum pistons, put on a Chevy oil pan and pump, big valves and a high-tension magneto. She swings the Flottorp prop at 1,800 r.p.m. on the ground or at 1,975 r.p.m. in the air. She takes-off in about 480 feet and climbs strong at about 450 feet per minute.

I test hopped it myself, and as I have had only 15 hours flying, you can see that the ship has no bugs. I did all of the construction work myself except for the intricate fittings and engine conversion.

I've never heard of a Model "T" Ford powering an "Air-Camper" before, so I bet myself that I could do it—and I did. The Air Camper was designed for the Model "A" Ford.



The "mainspring" is a revamped Model "T".

The Bemidji Club is Active

Here is the whole Bemidji club including the glider and the field.

AGAIN POPULAR AVIATION plans are at least partly responsible for the splendid glider built by the Bemidji Glider Club, Bemidji, Minn. They claim that they have had wonderful results with it although the members of the club had no previous glider experience.

It has been flown almost 80 hours without a crack-up and with only a few hard landings. There are four members in this compact little club, who reading from left to right in the picture, are Al Worth, Harold Hurlocker, Jack Kerr and Julius Miller, all of Bemidji, Minn.

They are looking forward to a lot of sport this winter on Lake Bemidji, a lake that is seven miles long and three miles wide. They employ towed flight with a 700 foot manila rope so that they get quite a ride.

Tinker Starts a Cabin Ship

Framing plan of the Tinker cabin job. It is wood construction.

C. C. TINKER, Lapeer, Mich., is building an interesting light cabin plane of the single-place type. He not only sent the accompanying photograph but also sent framing drawings that show the arrangement of the structural members. This latter data should be of value to those who contemplate building a cabin job of this type.

The entire ship is of wood construction, that is, it is built up of wood compression members and has wire tension members instead of being a tubular steel job. The structure is made of ⅞ inch ash and spruce and will weigh 540 pounds empty or 675 pounds when loaded with a 135 pound pilot.

It is to be equipped with a 30 h.p. radial engine. No doubt Mr. Tinker will discover what the old-timers discovered when they built up a wood-wire structure. That the making of the fittings with this type was more work than all the rest of the ship put together. The fittings at each panel point are quite complicated and heavy, for they must hold as many as eight different members together at one time.

The cabin ship before covering.

An Air-Minded Mortician

by DUANE T. PAXTON

WHEN anyone mentions an undertaker, he at once thinks of that personage as being sober, quiet and sad-eyed with a drawn look that would cause a fellow to feel sorry for him and wish that he could do something to cheer him up. Well, by golly, here's one so-called Mortician that plays Jeykell and Hyde week in and week out and the best part of it is that I get by—at least no one has offered any very threatening objections.

A few years ago, I got the idea into my head that I was going to be an aviator. I not only got the idea into my head but I immediately decided to be one and not to waste any time at it either. I was a senior in high school when I began to study aviation and I can actually say that the teachers had a hard time trying to teach me anything. I drew airplanes, thought airplanes and talked airplanes until even the profs began to see airplanes in their sleep. Anyway I had made up my mind and that was enough.

I built several gliders that year, the story of how I built a $300 training glider for only $70 was in good old POPULAR AVIATION about two years ago. I built another glider of my own design after that and had pretty good luck with it considering a first attempt.

Along in the early part of 1928, I had begun playing with a dance orchestra. Through that, I made enough money to buy materials for more gliders and airplanes and believe me it all went for that too. Soon after I had completed my second glider I had a chance to trade it, plus a tidy pile of dollar bills, for a dandy little one-place plane that a fellow here in town had bought a few months before and had hardly used. Believe you me, I thought I was somebody.

One of the fellows playing in the orchestra was the son of a prominent undertaker and we held many an orchestra practice within a few feet of the morgue. Well, to make a long story still longer, I began working for this undertaker and before I knew it I was playing host to the dead.

Undertaking, of course, is my real work, the aviation and orchestra ends are just hobbies that I get a real kick out of and honestly enjoy.

I wish that all of POPULAR AVIATION'S readers might come to Aurora and visit me for a few days. I believe there is more aviation activity here than in many cities ten times as large. I live just a half mile from the city airport where John Livingston, the world-famed pilot who has never failed to finish in the money at any air show, hangs out during the day.

Almost any day, during the summer especially, I can walk out into the back yard and see Livingston or one of the other pilots practicing for some

(*Concluded on page* 189)

BARTER AND EXCHANGE DEPARTMENT

78 SWAPPING OFFERS

This service is free to all of our readers, but the publishers reserve the right to reject any or all notices that are not in accord with the policy of this magazine. Only trades or "swaps" will be permitted. For cash deals, buying or selling, refer to our Buyer's Directory. Readers are urged to use caution in arranging trades and references should be mutually exchanged.

CHEVROLET ENGINE, half converted, tail group parts covered and uncovered, and other items suitable for lightplanes. Will trade for a good typewriter. Write for details.—Wm. Brack, Jr., Factoryville, Pa.

4-CYLINDER MAGNETO to trade for an 8-cylinder magneto or altimeter. Will also trade 4-foot propeller for a Cleveland lightweight motorcycle.—Manka, 452, Lamar, Colo.

FORD COUPE, 1930 Model "A," to exchange for a good lightplane, Curtiss-Wright, Jr. or Aeronca preferred. Will pay cash difference if ship is worth it.—P. M. Pratt, Rexburg, Idaho.

HEATH PARASOL wanted, late model or Model V. Parasol. Must be a welded job. Also want B4 engine. Dalmar Kamm, 524 11th St., Oshkosh, Wis.

AUTO-MECHANIC will overhaul and rebore automobile engine in exchange for a used Continental A-40 aero-engine, a Church Marathon J-3 engine, a Heath or Church knockdown construction kit or what have you?—Louis Kantor, 1566 Hoe Ave., Bronx, N. Y.

TYPEWRITER or printing press wanted. Will trade almost anything such as finished model planes, magazines, etc.—William Neubauer, North Olmsted, Ohio.

HEATH PARASOL, slightly damaged. Will trade for a good car or 1931 motorcycle. Little time on the Heath, or on its engine. It has a steel fuselage. Also used Heath parts.—Arnie Pederson, New Effington, S. Dak.

2-PLACE AERONCA wanted. It must be licensed. What do you want?—Harold Eddington, 2531 27th St., Rock Island, Ill.

MODEL "A" FORD Coupe with low mileage on it and in perfect condition. Will trade for a 1-place or 2-place lightplane.—J. Russell Crow, R. F. D. No. 1, Moundsville, W. Va.

SCALE MODEL, 15-inch, Boeing P-12-B and also a 20-inch twin pusher model. Will trade either of these models for past issues of POPULAR AVIATION, air fiction magazines, old stamps or what have you?—Joseph Zishka, Nortonville, Kan.

PICTURES of modern speed-planes wanted, particularly of Ben Howard's "Pete" or Al William's "Mercury." I have some 1932 National Air Race pictures to trade.—Russell Brinly, 1409 Forres Ave., St. Joe, Mich.

WASHING MACHINE ENGINE (Gasoline) wanted. Anyone wishing a good trade with me, write for particulars. I have much to trade.—Arthur Capizzi, 112 Hudson St., New York City, N. Y.

FISHER BODY Craftsman Guild's Complete kit for Napoleon's coach. This kit contains all of the wood parts and metal castings necessary for building the coach. Will trade for something worth about $10.00—the price paid for the kit.—Gordon A. Nesbit, 1722 Central Ave., Anderson, Ind.

MODEL PROPELLERS, hand carved flying type, 6", 8", 10", 12" sizes. Will trade for balsa wood and other model parts.—Frank Greenlee, R. F. D. No. 2, box 59, Boulder, Colo.

COURSES AND BOOKS. I want to trade: Correspondence Course by Walter Hinton, Nine Aviation maps of the Atlantic Coast, Dyke's Engine Instructor, The Aeroplane Speaks, Barber's Aerobatics. Yancy's Aerial Navigation and Meteorology and B. W. Down's, The Modern Airplane. They cost me about $70.00. Prefer a sail canoe. What have you?—Carl Reutershan, 305 E. 196 St., New York City, N.Y.

WANT ANZANI 10-Cylinder engine, converted by Brownback, less magnetos, carbureter and scavenger pumps but including propeller hub. Must be in good condition. Will trade an OX-5 that has not had time since a major overhauling. Please act promptly.—H. G. Warner, Fountaintown, Ind.

CORRESPONDENCE COURSE in aviation. Will trade for a motorcycle or an airplane engine.—Clair Rozelle, 736 E. 2nd St., Delphos, Ohio.

LIGHTPLANE WANTED, or materials for building a lightplane. I also wish to get an aviation engine between 25 h. p. and 75 h. p., or tools for a home workshop including a steel lathe. I have a Hudson coach and a complete line of new and used pianos to trade.—Dick McKenzie, 309 Milwaukee St., Janesville, Wis.

2-FUSELAGE, 10 feet long, uncovered. Will trade them for a Maytag gasoline washing-machine engine or Smith Motorwheel.—Robert Becker, 4 Bernard Ave., Poughkeepsie, N. Y.

1930 CHEVROLET Special Sedan, 6 wire wheels, in A-1 condition, low mileage. Will trade for a Warner Powered monocoupe, Cavalier or similar plane in good condition.—O. W. McIntosh, Box 216, Parsons, Kan.

GLIDER in first-class shape. Will exchange for a 16-24 h. p. outboard motor or what have you?—Howard Bettis, Sparta, Mich.

BOOK WANTED. I want a copy of "Jump" or "Parachute." Will trade one dozen 2½"x 4¼" photos of commercial, army and navy planes including Hawks in his "Texaco 13" and the DOX.—H. E. Brennert, 721 Grove Ave., Grantwood, N. J.

1928 INDIAN SCOUT, a Mill's Novelty slot machine, a Puritan Baby Bell, Nickel-dime-quarter ball gum machine, all in good shape, to trade for lightplane.—Francis Loy, 2619 Bloyd Ave., Indianapolis, Ind.

AMERICAN AERO MAGAZINES to trade for foreign aeronautical publications. Also interested in photos and negatives.—Edward A. Klatt, 14 Clinton St., Delhi, N. Y.

LIGHTPLANE WHEELS (20 x 2) and other aircraft parts wanted—Will trade primary glider (minus wings and wires), Model "T" with prop, magneto and oil pump; drawings for sportplanes, Harley "74" motor unassembled, new 10 shot 22 target pistol and lots of other parts.—Herman H. Gerlach, Jr., 108 Piaget Ave., Clifton, N. J.

EVANS GLIDER plans to trade. What have you?—Sterling Hostetler, Topeka, Ind.

CLIPPINGS. I have a small collection of airplane clippings and wish to enlarge it. I want any kind of airplane clippings, clean and of nice size.—Robert B. Krauss, Jr., 209 Marlboro St., Ardmore, Pa.

BOWLUS GLIDER, training type and nearly new. Also a "Peel" water glider, new but shopworn. I want utility gliders, lightplanes or what have you in this line?—Carroll Bean, R. F. D. No. 2, Carmel, Me.

FORD PROPELLER or Chevvy Motor. Will trade either of them for a factory made short-wave radio receiver, A.C. preferred. Prop is in good condition, used only two hours.—Harry Johnson, R. F. D. 2, Box 31, Lemont, Ill.

HISSO ENGINE, Model H, will be swapped for a 20-40 h.p. engine or Heath wings and materials.—M. E. Walters, R. F. D. 2, Box 17, Bethel, Conn.

LIGHTPLANE WANTED, in good condition. What do you want?—David Smith, 139-11, 223rd St., Laurelton, N. Y.

LIGHTPLANE WANTED, preferably an Aeronca C2 in good condition. I am also interested in getting a Monocoupe. Will trade my car for the plane.—M. E. Updike, Lebanon, Ind.

OX-5 AERO ENGINE, complete and ready to run. It has had only 100 hours. Will trade it for a converted Model "A" Ford engine or any other lightplane engine of the same horsepower. I also have a Berling magneto for an OX-5 engine. Will trade it for a Paragon propeller or any other propeller suitable for a converted Ford Engine.—John R. Dowalo, 144 Thompson Ave., Donora, Pa.

AIRPLANE PARTS, instruments, completed airplane, glider or parachute wanted. I have dozens of fine things to offer in trade for any of the above items.—Elmore Cauthen, Box 602, Summerville, S. C.

CURTISS Jr. WINGS wanted, complete with ailerons and controls, also complete set of struts, one gas and oil tank, Flottorp propeller for Szekely and one Szekely 45 h. p. engine. Will consider the above, either in good or damaged condition. What do you want?—V. A. Campbell, 714 N. A. St., Tampa, Fla.

1930 CHEVROLET Special Sedan, 6 wire wheels, in A-1 condition. It has had good care and a low mileage. Will trade for a Warner powered Monocoupe, Cavalier or similar plane in good condition.—O. W. McIntosh, Box 216, Parsons, Kans.

POWERED GLIDER in excellent condition. A good flyer. Powered with a four cylinder engine. Will trade for a motor boat or what have you?—James F. Schafer, Covington, Ky.

SIMPLEX MONOPLANE PARTS (unused) for a licensable 2-place Kinner powered plane. Fuselage (less doors), cowling and covering. Tail group (less covering). Landing gear (less wheels), brace wires and Wings complete. Will trade for lightplane engine or good motorcycle. Full set of instruments included. Photo on request.—J. L. McCoy, Napoleon, Ohio.

1930 GRAHAM-PAIGE SEDAN. Will trade for a 3-place biplane that can be licensed when overhauled. Prefer OX-5 Travelaire, Bird or Challenger. Will also trade for a radial engined ship that has been crashed but which is repairable. The Graham-Paige is in good condition, motor just overhauled. Is dark blue with red wheels. Has a 4-speed transmission with a silent third speed. Wish to trade at once.—Walter Aubert, Hersey, Mich.

VELIE MONOPREP or other reputable lightplane wanted. Must be in good flying condition or only very slightly damaged. Send full details to R. C. Pomeroy, North Olmstead, Ohio.

LIGHTPLANE or powered glider wanted. Prefer a slow landing plane with a large wing surface. Will also consider a sailplane or a secondary glider. Write to Hugo E. Meyer, Cole Camp, Mo.

AERO-ENGINE WANTED, 50-65 h. p. with a 5 or 6 foot prop. Must be in good condition. Will pay shipping charges.—Gus Heim, Lovell, Oxford County, Maine.

LIGHTPLANE PROPELLER, 6-foot diameter, 3½-foot pitch. Fits one inch shaft. Will trade for a correspondence course or aeronautical books.—Raymond Bobeg, R. F. D. 2, Arcadia, Wisc.

CONTINENTAL A 40 ENGINE in splendid condition, Stromberg Carbureter, German Bosch magneto. Also 16 x 4 aluminum wheels and tires. Continental-Heath engine mounting. Will trade for Arrow Sport or N. B. Trainer in good condition. Will pay cash difference.—Gregory and Gallaugher, care of Mutual Creamery, Lewiston, Idaho.

STRESS ANALYSIS. Will trade services for making a stress analysis, or giving technical advice, for a Henderson Engine, lightplane parts, or what have you? I am an advanced student in Mechanical and Aeronautical Engineering, Tri-State College, Angola, Ind. Can refer you to Prof. L. A. Ott, head of aeronautical Engineering Dept. Tri-State College.—Kenneth R. Lung, 922 Mayer St., Kendallville, Ind.

LIGHTPLANE WANTED, Heath or similar ship preferred. Must have Dept. of Commerce license or be eligible for this license. Write to me and tell me what you want.—Earl Bradford, Whitnel, N. C.

MOTORCYCLE ENGINE, Excelsior Twin with Bosch Magneto. Excellent for hedgehopper, iceboat or windbuggy. Will exchange engine for a small electric radio or what have you?—Robert N. Anderson, 431 Welch Ave., Ames, Iowa.

ALCO SPORTPLANE, complete except for engine. Will swap for a converted Henderson or Indian four-cylinder engine. Engine to be used on my Heath Parasol. Write for information.—Marvin Padley, R. F. D. 7, Baraboo, Wisc.

(Concluded on next page)

Barter and Exchange

(*Continued from page* 175)

BLUE-PRINTS for Boeing Army P-12F or Navy F4B3. Plans consist of two sheets 21" x 29" and are excellent for model building. Drawing of wing is 24". Will trade them for plans of other modern airplanes or what have you?—Robert Pohl, 782 West 4th St., Pomona, Calif.

GNOME ENGINE, 9-Cylinder, 100 h. p. aircraft engine, to trade for a metal cutting lathe or what have you? The engine has only run for 5 hours.—J. H. Hachmann, Belleview, Iowa.

CHEVROLET SEDAN, Landau, A-1 shape, just thoroughly overhauled, looks like new. Will trade for Aeronca, Bull-Pup, Eaglet or similar ship.—A. E. Thompson, Lakota, N. Dak.

LAWRENCE ENGINE, 2-Cylinder with prop, 20 x 4 wheels, tires, 1930 Model "A" Ford converted. What have you?—Stan Wright, Airplane Glider Supply Co., 125 No. 36th St., Seattle, Wash.

BLUE-PRINTS for Crawford A. 1. Monoplane. Also 1931 and 1932 copies of Flying Manual with plans to build various Planes and gliders. Will trade for a small radio set or parts.—L. E. Stathem, Riverdale, Calif.

REMINGTON TYPEWRITER, Benjamin Single-Shot air rifle, Tungar charger, Electric radio speaker, Henderson motorcycle (twin) magneto, photos and clippings, pilot for parachute, sample of wing section with 3 ribs, sample of propeller. Will trade for any type of electric train but prefer Lionel large train.—Henry Rydiewski, 5124 West 31st St., Cicero, Ill.

CORRESPONDENCE COURSE. Complete and in good shape. 500 back numbers of magazines and 15 books on hunting, fishing and trapping. Also an old time rifle, 0.43 Cal., and instructions for converting Ford Model "T" engine. Used radios. Will take back numbers of POPULAR AVIATION, psychology, radio magazines, correspondence courses. What have you?—John Karlstad, Banks, N. Dak.

CORRESPONDENCE COURSE, Dayton School of Aviation. Will consider anything in trade for this course.—Raymond Dalton, Box 801, Nogales, Ariz.

CORRESPONDENCE COURSE. A Cooke electrical engineering course. Also a five volume library on automobile engineering. Both like new. Will trade for printing press, or what have you?—E. Norgren, Centerville, N. Dak.

CORRESPONDENCE COURSE. A $60.00 course by the American School of Aviation. Will exchange for a portable or standard size typewriter. Must be in good condition.—Ben Weathers, Knapp, Tex.

AIRPLANE WANTED. I want an Eaglerock or American Eagle for training. Would like to form a flying club, and if owner of plane is a pilot, I might be able to use his services for a time. Write terms.—Victor Ott, 542 Nilsen St., Laport, Ind.

SLIDE TROMBONE, Couturier, triple silver finish, with case. A $118.00 outfit, used about 2 months, and in A-1 condition. Want a good used motorcycle, no junk. I also have a complete course in piano accordion playing, also portfolio of popular accordion music. Want an electric phonograph, motor and table. What have you.—Ralph E. Bennett, 502 W. Grove St., Pontiac, Ill.

PHOTOS. I have airship pictures of every description, pictures of the Akron and Macon under construction, etc. Size about 4" x 4". Will swap these pictures for old-time planes, the latest government jobs or construction pictures of any kind of plane.—Wm. Bill Rogers, 554 Talbot Ave., E. Akron, Ohio.

PHOTOS WANTED. I want photos of the Fokker D-7, Bristol Bulldog, Curtiss P-6-E, Boeing P-12-B.—Carl Shrader, 27 Borroughs St., Jamaica Plain, Mass.

PHOTOS. Will trade photographs of all sorts of planes, preferably World War planes, with readers in all parts of the United States, Canada and England.—H. T. Olson, Box 39, Inwood, Iowa.

PHOTOS. Actual photographs of airplanes to swap, modern and military. I wish to increase my collection.—Fred Miffenegger, Jr., 422 24th St., North, St. Petersburg, Fla.

PHOTOS. I am just starting a collection of photos and would like to hear from the members of the Photo Phans club about getting photos. Would like R-11, Bayles and war photos.—Carl E. Shellman, 25 Bartlett St., Springfield, Mass.

MISCELLANEOUS. I have many books along all sorts of lines, materials for models, model blue prints, new 1000 ohm earphones, a $14.00 wrist watch which can be repaired for $1.00, modern electric movie projector, a great many films for the projector, etc. I wish to have books on aviation, or will trade for a motorcycle with a possible addition of cash.—Joe Michaels, Jr., Box 202, New Hampton, Orange Co., N. Y.

MISCELLANEOUS. Will trade Luxor No. 7 Goggles and Stevens 22 cal. rifle for a Boeing P-12-E or (C), or a Gee-Bee "Silo" non-flying scale model. Model should have a span of 12" or greater. Send photo of model.—Walter Godleski, 115 E. 21st St., Homestead, Pa.

CLIPPINGS. Wish newspaper or magazine clippings describing Lindbergh's flight, the wreck of the Shenandoah, the Post and Gatty Round the World trip and others of the same kind up to January, 1932.—Alex Lenart, 10 High St., Wallingford, Conn.

BOOKS. Set of 15 volumes, High School Books ("Blue Books"), cost me $20.00. Will trade for any book or books dealing in aviation engines, listing at $5.00. Will also trade for a good washing machine motor or any other motor. What have you?—Bennie F. Palmer, Sandstone, Minn.

BOOKS. I have Dyke's Aircraft Engine Instructor, Aircraft Year Book for 1932, A. B. C. of Aviation (Page), Western Electric microphone, about 2,000 airplane pictures clipped from magazines, Vest Pocket Kodak, and pair of field glasses. Will trade for Aeronca propeller, rifle, radio, telescope or binoculars. Will answer all letters.—Joe Buckley, 3461 Jasper Ave., Philadelphia, Pa.

If your "ad" does not appear, it may have arrived too late for this issue. It will appear later.

Amy Johnson's Lightplane Record

AMY JOHNSON, England's premier woman flyer, took the England-to-the-Cape speed record away from her husband, Captain J. A. Mollison, when she brought her monoplane, the Desert Cloud, down at the Cape Town airport just four days, six hours and fifty-five minutes after her takeoff in Britain.

She had clipped over ten hours off her husband's record, and might have done it in less time except for two delays in the flight. The first one came after she had crossed the Sahara Desert and had put out from Gao, on the upper Niger. She had not noticed that her gasoline was running low and two hours out of Gao she was forced to turn back and refuel.

The second mishap occurred at Benguela, which is in the rainy belt. An oil filter was faulty and owing to the lack of proper tools and the heavy rains, it looked for a time as though the flight would have to be abandoned. But after a time the difficulty was overcome and Miss Johnson was able to complete the trip in record time.

Schenfeld's Sailplane

This Schenfeld glider is a nifty job.

DAVID SCHENFELD, 820 Gravesend Ave., Brooklyn, N. Y., with a friend, built this nifty Mead soarer which is the third glider that they have built. It has a span of 36 feet and weighs 200 pounds empty.

Benefiting from their previous experience, they have made a number of changes in the original design. They used wood for the drag and anti-drag braces instead of wire, and rearranged the aileron control wires so that assembly was simplified. They also eliminated the top aileron horns by this change. As it stands now, they can assemble the wings in five minutes.

They have enjoyed many pleasant week-ends with the glider, and it has never been damaged. They intend selling it and using the money for building a lightplane.

An Original Design

THIS lightplane, owned and built by Oscar S. Williams, 3 Baxter Avenue, Elizabeth City, N. C., is a sort of a combination design. It was originally a Pietenpol design, but it has been modified somewhat and combined with Russell and Heath ideas.

It has a span of 30 feet, length 17' 6", height 7' 0" and weighs 600 pounds with water. The Model "A" Ford engine swings a 6' 6" Flottorp propeller at 1,800 r.p.m. on the ground. Since these snapshots were taken, this skybuggy has been completed and at the time of writing, the test hops were in session.

Well, we wish you all the luck there is, O. S. W., and we hope that we will hear how she's flying after she is all lined up. We always like to hear of original ideas being incorporated in a design and hearing about how they turned out.

Oscar Williams' plane before covering.

New Ideas for Our Model Builders

Hints, kinks and new model flying stunts gathered from far and near for our model builders.

Model Dope Facts

DON'T leave the cover off your cement can. It becomes very thick and is very hard to use in working on your model parts. Keeping the cover on the can will prevent odor.

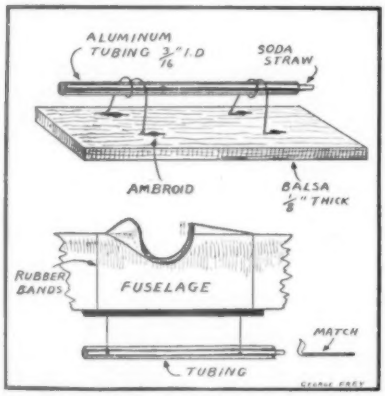
If your model cement gets too thick, use acetone or "banana oil" as a thinner. In using model airplane cement for joints, first clean the parts by sandpapering. Then apply the cement and allow to dry. Then follow with another coat and place the parts together and allow them to dry and harden.

Don't use too much cement for holding parts together for it is this excess cement, in a great many cases, that makes your model too heavy to fly. Use only the necessary amount of cement.

Apply the cement as neatly as possible to all the joints that they may have that quality of workmanship that you will be proud of.

Cement the joints of your model only and not your hands or clothes. This is carelessness.

How to Lay a Smoke-Screen



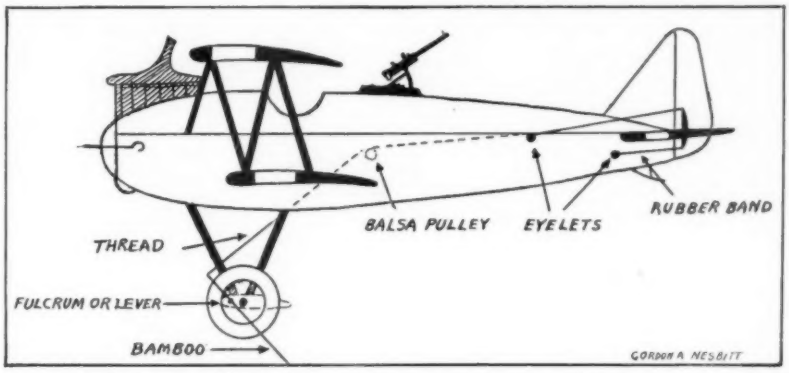
By using a little firecracker powder, we can lay a fine smoke screen.

GEORGE FREY, 4791 Cypress St., Pittsburgh, Pa., celebrated last Fourth-of-July by putting a smoke-screen cartridge on his model airplane. This is shown clearly by the accompanying drawing in detail—down to the sketch of the match.

The cartridge consists of a 3½ inch length of ⅜ inch inside diameter aluminum tubing. This tubing is attached to a strip of balsa by a set of wire clips, two small holes being drilled into the front end to receive the clips. The whole device is now held to the fuselage by rubber bands.

The chemicals are packed into a soda straw which is then placed in the tubing and is ignited with a match just before the model is launched.

This Scheme Improves Landings



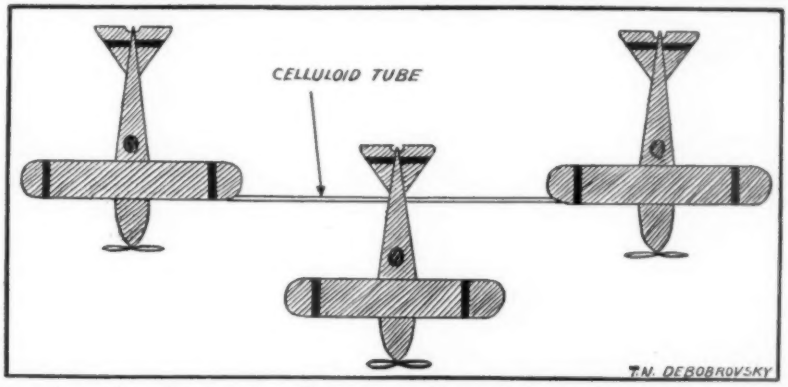
A good landing is an achievement in model flying, and by the method above, good landings are assured.

GORDON A. NESBITT, 1722 Central Ave., Anderson, Ind., likes to have his models make nice landings, three-pointers wherever possible. And so, after some experimenting, he arrived at the arrangement shown by the accompanying sketch that works very nicely.

First, a piece of bamboo rod is hinged to the spreader bar of the landing gear, and this is connected to the elevators through a wire as shown. Underneath the elevators are rubber bands which act as a load for the bamboo stick and act against it.

Now, when the ship is about six inches off the ground, the bamboo rod strikes, moves the elevators up and thus brings the tail down so that a three-pointer is made. The rubber band holds the elevators horizontal during flight.

How to Make a Squadron Formation Flight

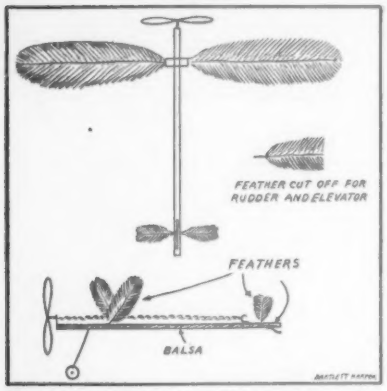


Here they go in perfect formation. Tied together with a celluloid tube they must be in perfect alignment.

MR. T. N. DE BOBROVSKY, 4 Cubberly Place, Jersey City, N. J. has submitted a novel and interesting scheme for flying models in formation. We can see in advance that flying this squadron of three pursuit ships in formation will contribute a lot of fun to model flying and we hope to hear from those of our readers who have tried it.

As indicated in the sketch, three flying pursuit models are connected together in squadron formation by a celluloid profile tube, and as the celluloid tube will be invisible, the climbing, banking, rolling and zooming of the three connected models will give as much of a thrill as a real Army Air Corps exhibition.

Build a Featherplane—It's Simple



This is the ultimate in model simplicity. Get some feathers and try it.

HERE we have a real novelty—a model with turkey feathers for the wing and tail. It is simplicity itself, having no ribs to cut nor any paper hanging to do after the wing is assembled.

This suggestion comes from Bartlett Harper, 706 Cemetery St., Natchez, Miss., who has designed a mighty clever little model. All that is needed is some stiff turkey or goose wing feathers, a balsa motor-stick, some wire and an 8-inch propeller.

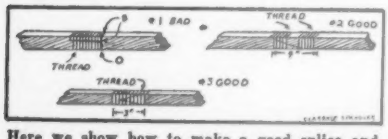
The quills of the wing feathers are stuck into the motor-stick and are glued. For the elevator and rudder, the feathers are cut shorter than for the wings. Stiff wires for the landing gear struts, bearings for the propeller and you are all set. No dimensions are possible because of the variations in the feather sizes.

How to Make Splices in Members

WHEN two balsa rods are spliced together, or where splices are necessary in making repairs, it is best to study the nature of splices so that the best results can be had.

Clarence Spangler, 348 N. Platte Ave., Fremont, Nebr., shows three different methods of splicing. Splice No. 1, a most common type of splice, is very bad as it tends to crack at (B) and later to fall apart at (O).

The single lap-joint of No. 2 is good and the same is true of the fishtail splice No. 3, either of which are fully as strong or stronger than the wood. The surfaces are covered with a good glue or cement, and are then wrapped with thread. After the splice cement is dry, a little cement applied to the thread will help.



Here we show how to make a good splice and what to avoid. Both of the lap joints are good but the mortised joint (No. 1) is weak and subject to cracking.

About the Rubber Motor and Prop

MUCH of the success or failure of a model is chargeable to the proportions existing between the size of the propeller and the amount of rubber in the motor.

A large diameter propeller is usually advisable, especially with scale models having a large blunt nose. The nose of such models screens off a considerable proportion of the area covered by a small propeller, hence a large diameter is essential. Very frequently, the bracing of the model interferes seriously with the slip-stream of the propeller, thus reducing the thrust that might otherwise be obtained.

A considerable amount of power can be stored in rubber strips but ordinarily much of this power is wasted. The prop must turn very easily in its bearings and the center of the rubber strands should be central with the propeller shaft. Again, to develop the greatest amount of power, the rubber strands should be stretched to about twice the orginal length while winding or twisting them.

Lubricating the strands of rubber with a vegetable oil such as castor oil or corn oil will reduce the friction between the strands and will improve the delivery of power and increase the total number of turns possible.

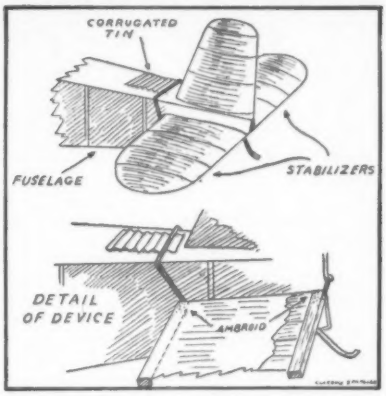
But, even with the frictional losses reduced to a minimum, the best results cannot be obtained unless the propeller is properly proportioned to the rubber. If the propeller cannot absorb all of the motor power at the desired speed, then it will run too fast. As a result, the flight will be of short duration, though faster than normal. The propeller will over-speed if its diameter is too small, if the pitch is small or if the blades are narrow. Any one of these three causes will reduce the duration of flight.

Now, the rate of delivering power depends both upon the length of the rubber and the number of strands, using a given size of propeller. Increasing the length of the rubber increases the duration, while increasing the number of strands increases the propeller speed but reduces the duration. And, don't fail to note, that an increase in the length or number of strands increases the weight and therefore calls for a higher flying speed than with a smaller weight of rubber.

If, for example, the motor does not turn the propeller fast enough to fly the model, or flies it too slowly, then one or more strands of rubber can be added or another propeller should be substituted of smaller diameter or pitch. More rubber or smaller propeller dimensions will increase the propeller speed.

If the flight duration is too short, this can be improved in either of two different ways. First, the length of the rubber can be increased. Second, the propeller diameter or pitch can be increased if the prop is turning at too high a speed.

Model Elevator Control



This is a convenient method of adjusting and holding the elevators in the proper position.

CLARENCE SPANGLER, 348 N. Platte Ave., Fremont, Nebr., has devised a means for adjusting the elevator surfaces so that the model can be looped and stunted.

This device consists of a wire loop or "U" shaped piece, the two ends of which go to the elevator surfaces while the looped portion saddles the rear end of the fuselage. This loop and the elevators can then be held in any position by a rack consisting of a piece of corrugated tin.

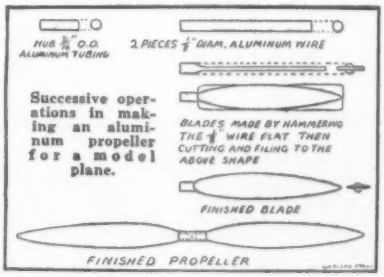
The rack is cemented to the top of the fuselage with cement or dope. The ends of the saddle that go into the stabilizer should fit snugly into holes drilled in the elevators but should not be cemented.

Making an Aluminum Propeller

THE accompanying drawing shows how to make an aluminum propeller very easily from aluminum wire. This clever idea was submitted by Gaylord Specht, 1104 B Ave., East, Oskaloosa, Iowa.

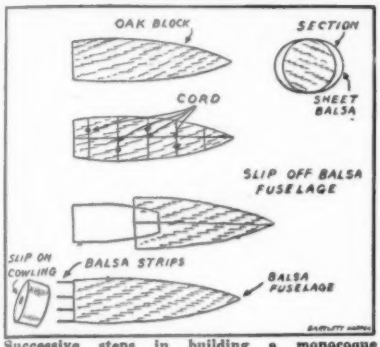
First, we get two pieces of ⅛ inch aluminum wire and also a short piece of aluminum tubing having an outside diameter (O. D.) of ⅛ inch. We now hammer down one of the pieces of wire until it is flat as shown, leaving a short piece round at one end for fitting into the tubing used for the hub.

The flattened wire may be finished to the required shape by filing, and when the two blades are completed, they are assembled into the completed propeller shown at the bottom drawing.


HUB ⅛" O.D. ALUMINUM TUBING
2 PIECES ⅛" DIAM. ALUMINUM WIRE
BLADES MADE BY HAMMERING THE ⅛" WIRE FLAT THEN CUTTING AND FILING TO THE ABOVE SHAPE
FINISHED BLADE
FINISHED PROPELLER

Successive operations in making an aluminum propeller for a model plane.

A Model Monocoque Fuselage



Successive steps in building a monocoque fuselage.

BARALETT HARPER, 706 Cemetery St., Natchez, Miss., sends in a good idea for building a monocoque fuselage shell suitable for Lockheed models, etc. He first makes a former of exactly the same size and shape of the desired fuselage and then steams and applies thin sheet balsa to the former.

Get a block of oak or other hard wood and turn it down to shape on a lathe as shown. This gives you a former that can be used repeatedly. Then get two pieces of thin sheet balsa, each large enough to cover half of the former and thoroughly steam them until they bend easily. Carefully cover half the former with the steamed balsa, and then apply the second half in the same way. Glue the edges of the balsa, then wrap the sheet with cord until it becomes dry and "sets".

After drying, remove the cords and slip the completed shell from the former. If the balsa will not shape well, use a few bulkheads to hold it into shape. This makes a strong light fuselage that is easily painted and which shines like glass when polished.

A Compressed-Air Model

VERNON L. CALHOUN, Route 9, Lafayette, Ind., sends us a photograph of his six foot compressed air model—a view taken before the model was covered. It will be seen that the wings are built up like the wings of a large plane—latticed main ribs, subribs and stringers. Adjustable ailerons are employed.

We would like to have you give us some dope on the performance of this model, Vernon, for we get very little information of this kind.

A view of the compressed-air model.

Latest Dope on the Model Contest

Model builders all over the United States and Canada have been busy during the past three months building models for the P. A. contest.

BIG models, little models and all sorts of models have been pouring into P. A.'s office until there is hardly breathing room. Boxes that bear the names and addresses of readers all over the country—from coast to coast, England, Canada and Hawaii.

At the time of going to press, none of the boxes have been opened as we prefer to wait until all of the entrants have arrived. And what an exhibition that will be! We only wish that all of you could be present to witness the display which will be held for fifteen days at Marshall Field's department store in Chicago.

Marshall Field and Company have very generously donated a great deal of floor space for the model exhibit and will announce the contest through their newspaper advertisements and over the radio. This means that thousands of Chicago model fans will be able to view the world's champion models and profit by what they have seen. The models will be placed in glass showcases for protection, and a guard will be at hand at all times as an additional insurance against breakage or loss.

When all is installed, the judges will award the prizes to the winners, and as we will have some notable judges and model experts give their opinion, you may feel certain that their decisions will be fair and just to all of the entrants. This will mark an epoch in model contests because of the magnitude of the affair and because of the great variety of models shown.

During the course of the exhibition, several notable men in the aviation field will speak on interesting subjects pertaining to models and aviation in general. A member of POPULAR AVIATION'S staff will be in attendance at all times to describe the models and give any information that the spectators may desire. It will be a real Model World's Fair.

We will not depend upon the opinion of any one person in making the awards, the findings of one judge will be checked and double-checked by the other judges to make certain that the prizes go to the deserving models. There is no possible chance for favoritism being shown to any model, and the winner will be a winner purely on its merits.

Then, after all of the excitement is over, and the awards have been made, the names of the winners and photographs of the winning models will be given in the April issue of POPULAR AVIATION. This is certainly one issue that you cannot afford to miss, the issue that shows the world's best model airplanes. And following the April issue, we will give you the complete drawings of the winning models with full instructions for building duplicates.

The Art of Flying Models

by CHARLES P. UNDERWOOD

After completing your first model, you are up against the problem of flying it without unnecessary crackups. Here's how to proceed.

MANY of our new readers and beginners in model aviation, will undoubtedly be interested in a description of launching methods, for sooner or later they will be brought face to face with this problem. And, if the launching is not properly conducted, the result is almost certain to be a crash and a broken model. Hand launching is really an art and some people are always more adept at launching than others.

Starting at the beginning, after the arrival at the field, it will be necessary to wind up the rubber motor ready for the flight. In the small simple models, where no provision has been made for removing the rubber for winding, it will be necessary to wind the motor by turning the propeller in the opposite direction to the rotation in flight. This is not the best way in the world but it is sometimes made necessary by the construction of the model.

The larger or better models are provided with means for the removal of the entire motor stick or else there is an opening left at the back of the fuselage models through which the rear end of the rubber strands can be pulled out and stretched during winding. Many more turns or "knots" can be added if the rubber is stretched during winding, and thus more energy can be stored in the rubber.

Where access can be had to the rear end of the strands, they are removed from the rear hook and pulled out to a good tension, hooking the rubber to a rubber winder. This winder, greatly resembles a geared egg-beater (and sometimes made from one), will wind the rubber much more rapidly than attempting to twist it by hand. During the winding, the strands will twist up tight, then the first row of knots will form until the whole length of the rubber is knotted. Continued winding will then produce a second row of knots, and when this is completed, the motor is wound. The rubber is then returned within the fuselage (if a fuselage model) and replaced on the rubber hook.

It is obvious that stretch winding calls for two persons, one holding the model and propeller while the second performs the actual winding. The method of winding a twin-pusher type model is shown by an accompanying photo.

With the motor all wound, the propeller must be held securely to prevent it from turning until the launching. The exact method of launching depends upon the type of model, whether it is a single prop pusher or puller type or whether it is a twin pusher. In any event, properly launching a model is really an art that largely determines what the model will do when in flight. Some people are always more adept at this operation than others, and it takes practice to perform it properly.

Taking the case of the simple tractor single propeller type (with the propeller in front), the model is held in approximately a horizontal position with the right hand while a finger of the left hand keeps the propeller from turning. Many models work best when launched horizontally while others do best with the nose elevated slightly so that it will start to climb the instant that it is released.

It is necessary to impart a steady uniform forward motion to the model, giving it an "initial velocity" that will be sufficient to support it when it leaves the hand. And this is just where the art of launching comes in. It must be a steady uniform forward motion and

(*Concluded on page* 196)

To get duration, the rubber must be stretched when winding.

This is the way to launch a twin-pusher model.

Mr. Bristol launches his "Stinson R" cabin tractor at the high altitude of Cheyenne, Wyo.

Just after launching the twin pusher.

An Interesting Rotor Model

by EUGENE GRAY

Here is a brand new type of flying model that was developed after reading an article in POPULAR AVIATION. It is well worth trying out.

I WAS very much interested in an article by Al Strobel in POPULAR AVIATION, the June, 1932, issue, an article describing the various types of rotor ships that have been tried out. In fact, I was so much interested in the subject that I resolved to build a model of this type of aircraft, and the results are given in this story.

As you probably remember, the rotor-ship is lifted by a smooth surfaced revolving cylinder or spindle instead of by wings or a lifting propeller as in the case of the Autogiro. The lifting force, based upon Flettner's principle, depends upon the distortion of an air-stream passing over the revolving cylinders, the air pressure being reduced on one side and increased on the other side of the diameter.

In presenting the drawings for the construction of a model rotor ship, I I believe that the model builders of POPULAR AVIATION will get as much pleasure and kick out of the model as I did, and I believe that this experimental work will prove to be the most fascinating of all model construction. The exceedingly slow descent of the machine is most remarkable, and when flown in a breeze it will shoot high up into the air. And very strange to say, an actual trial with the rotor alone and without a propeller, will prove that the rotor will produce a forward propelling force as well as a lifting force, a fact not explained by writers on the subject.

I did not attempt to build a new type of ship from the ground up, but simply built a rotor as an attachment to an ordinary stick airplane model. Thus, I could get results quicker and with less work than I could by building a whole new machine. Therefore, the only job for you to do is to build the rotor and then apply it to any airplane model that you may have at hand.

I suggest, however, that when you have flown the rotor as I describe it, that you go a step further and mount a propeller on the machine to determine what effect the propeller will have on the lift of the rotor. There is a whole lot of experimental work to do that I have not yet touched upon and you will find these investigations extremely interesting and educational.

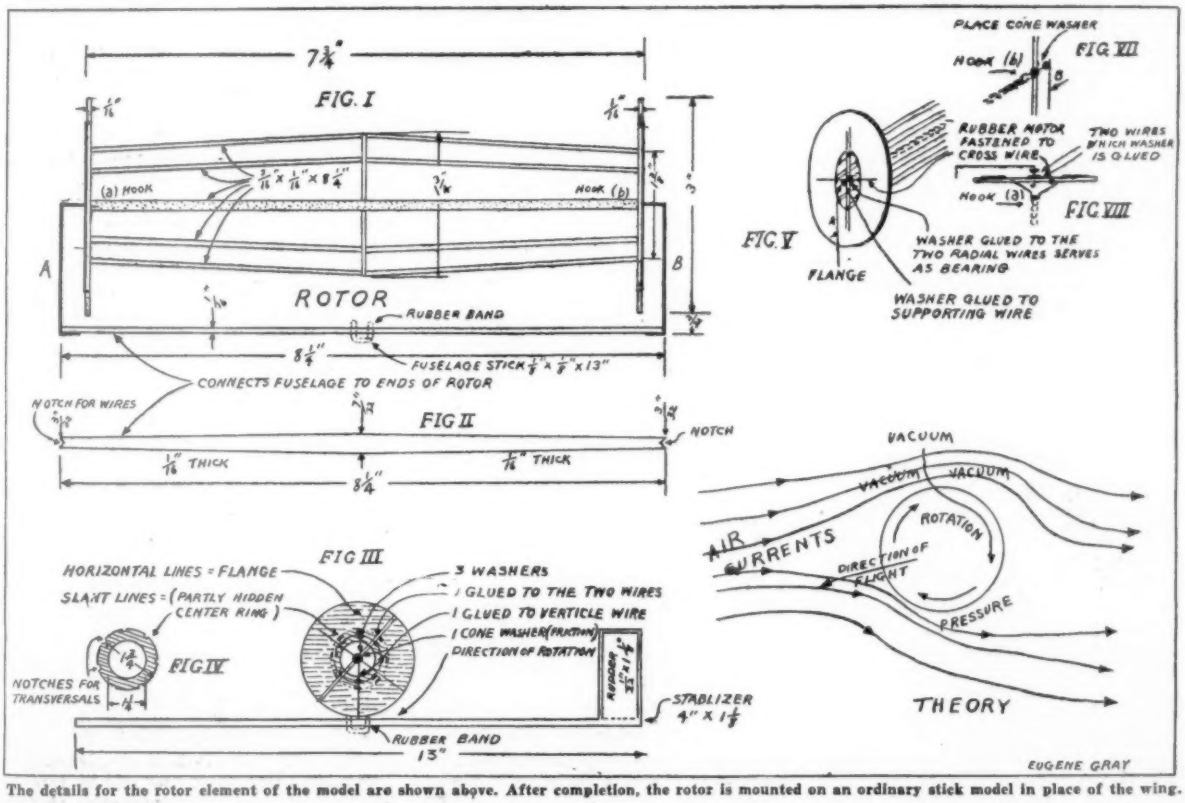
To begin with, the airplane model that I used as the basis of these experiments is of the usual type of "flying stick" composed of a 1/8" x 1/8" x 13" balsa motor-stick carrying a 4" x 1-1/8" stabilizer and a 2½" x 1⅛" rudder. These surfaces were cut from 1/32-inch balsa sheet. No wings are employed for the reason that the rotor takes the place of the wings and is supported at about the same place that the wings would ordinarily occupy.

BUILDING THE ROTOR

TO MAKE the rotor, start by cutting two circles 3-inches in diameter out of 1/16-inch balsa wood. Do not yet remove the inner portion of the circle. The most convenient method of cutting the circles truly round is to cut them with a sharpened compass point. It may be necessary to splice the balsa for the 3-inch circles, but this will be satisfactory if carefully done.

The center ring, having an outer diameter of 1¾ inch and an inner diameter of 1¼ inch, is also 1/16 inch thick and has eight notches cut on the outside for the eight former rods. This is shown by Fig. IV.

The bearings for the rotor are shown



The details for the rotor element of the model are shown above. After completion, the rotor is mounted on an ordinary stick model in place of the wing.

in Figs. V-VII-VIII, these bearings being simply washers with holes in the center for the reception of the shaft, a construction that is best shown by Fig. V. Two fine wires, about 0.025 inch in diameter and 2⅝ inch long are glued side-by-side to the flange as shown, with a small gap between them running through the center of the flange. In the exact center of these wires is glued the bearing washer.

Now, remove the inner portion of both the flanges (1⅛ inch diameter), but on one of these flanges another wire (a) (See Fig. VIII) is glued at right angles to the bearing supporting wires to engage the motor. A 3-inch piece of stiff wire is bent as at (A) in Figs. I and V and put through the hole in the washer and between the two fine wires. Another washer is then run upon this wire and glued. The latter washer acts as a stop.

At the point (a) in Figs. I and VIII we see how the rubber motor strands are attached to the rotor. The hook (a) engages the end of the motor, while the other ends of the rubber strands are connected to the hooked end (b) of the supporting wire (B). The latter arrangement is shown in Fig. VII.

Another piece of stiff wire is bent as at (B) in Figs. I and VIII, and is inserted through the washer on the other flange. Now run a cone washer up the wire and then a flat one, glueing the latter so that it will act as a stop.

Eight drum former rods are made of balsa, ⅛" x ⅛" x 8¼". The wires are now connected to the balsa cross-strips with glue as shown in Figs. I and II. To assemble the rotor, place a pair of pliers on the cross-strip so as to hold the flanges upright. Place two of the former rods in opposite notches of the center ring and bend their ends together slightly, placing them inside the inner ring of the flanges. Now glue them in place. Be sure to assemble the remaining former strips in pairs—fastening opposite rods at the same time so that a true cylindrical form will be obtained.

Now cover the formers with tissue paper, and if necessary to obtain a tighter smoother, surface, shrink the tissue by sprinkling it with water. The fuselage is attached to the rotor by means of rubber bands so that it will be easy to adjust the center of lift of the rotor to coincide with the center of gravity of the fuselage.

To wind the rubber motor, disengage the front end of the rubber strands with a wire hook and bring the rubber out by this means so that it can be attached to the winder. After winding, replace the rubber by means of the hook. The greater the number of rubber strands, the faster the rotor will turn but the shorter will be the duration of flight. The lift increases with the speed of the rotor rotation so that more rubber must be used if the device does not lift satisfactorily.

A Replica of the SPAD

by GEORGE G. HAYDEN

THIS month's solid scale model is a true scale reproduction of the famous World War S. P. A. D. A French pursuit single-seater of this type was the favorite of Colonel Eddie Rickenbacker and was used successfully in his encounters against the German Air Force to bring up his score of victories.

The wing span of the large plane was approximately 27 feet and the power plant, a Hispano Suiza, delivered 220 horse power. The wings were exceptionally thin with a trailing edge of wire which gave the peculiar curve at the end of the ribs. Because of the small span and thin spars, only one pair of full size struts was used with an additional set of four in between the outer strut and the fuselage.

This inner strut arrangement was primarily arranged to prevent the flexible wings from buckling near the center. A close study of the front and the side views will show the arrangement and the method of bracing employed. The ailerons were on the upper wings only and were operated by a push-and-pull rod employing a large triangular brace which was pivoted and attached to an upright streamlined section directly behind the rear outer bay wing strut.

And here's the completed SPAD replica—you'll be proud of it.

The wire bracing used on the main wings was exceptionally heavy and doubled throughout. The main wings were so thin and the ribs so light that the trailing edge was flexible. The landing gear had a streamlined center-board with that section cut away which permitted the axle to sink in flush with the top of the center board. At the center of the axle there was a hinge arrangement which allowed each wheel to operate independently, depending on the roughness of the ground encountered while landing.

Standard shock-absorbing cord was used and this was wrapped around the axle with a continous turn and was held in place to the front and to the rear of the wheel axle by a part of the center-board which extended out far enough to hold the shock-absorbing cord. The shock cord is clearly visible in position as illustrated.

The wing span of the model drawing is given as 4 inches and this size may be doubled or tripled depending upon how large a model the builder prefers to construct. An 8 inch model will cost only a few cents to build and is small so that it may be put anywhere within the home and not cause any inconvenience. The 12 inch size model will give about the best proportion of sizes which allow for ease of handling during construction.

The various ribs and tails sections are illustrated in full and may be enlarged proportionately to the wing span desired. A large underchamber is required for the upper and lower wings. The top wing has a center piece cut away so that the pilot has a clear vision when looking forward and upward. The lower wing on each side has a small section which cuts in in a similar fashion to the top wing.

BODY OR FUSELAGE

THE body is fairly thick, both in height and width. The top and the bottom are semi-circular with sides that are almost flat having rounded corners at all four points at the longerons positions. The headrest is a small piece of balsa streamlined and cemented in place just behind the cockpit on the top of the fuselage.

Where the stabilizer attaches, a small part of the fuselage on the top is cut away. The front of the fuselage at the radiator is a perfect circle and quickly tapers into a semi-circular top bottom with flattened sides and rounded corners. From the front view on the top side of the fuselage, 45 degrees out from the center, a small circular part is seen. This piece may also be noticed on the plan and side views. It is a streamlined part which goes over the cylinder banks which project through the body a short distance.

The cockpit should be cut out deep enough to include a seat. A small windshield should be added when the model has been completely doped and lacquered. The exhaust is solid balsa with small sections added which extend toward the body and cemented in place. The landing gear should be very strong and must therefore be made of small bamboo pieces. These pieces should extend into the body a short distance and cemented firmly in place. The tail skid is also bamboo and forced into the body.

TAIL GROUP

THE stabilizer is in one unit and the elevators may be in the same part. However, it is a simple matter to make these parts movable by inserting a small section of soft wire at two different points into each part, the

stabilizer and the elevator respectively. Note in particular that all the sections on this model are very thin.

This practice of thin sections was generally recognized by all aeronautical engineers until the close of the World War at which time thick wing sections began to appear. The construction of the rudder is similar to that of the stabilizer. The fin is attached on the top side of the body and to assist and help it to remain in a rigid position, small pins may be pushed into the body first, permitting small ends to extend into the fin. This same practice may be carried out when attaching the wings to the body.

PROPELLER

THE propeller is large in proportion to modern airplane props, but has been reduced to scale and should be copied to the size given. This part may be made from hard wood as it very often is the first part to be bumped and broken. A small piece of brass tubing having an inside diameter of 1/32 inch should be inserted to act as a bearing and to allow the propeller to revolve freely after it is held in place by a small nail pushed into the nose of the model.

The wheels should be turned up on a lathe from hard wood for best results and decorated to resemble a black tire with a silver center, having a star as a center design. On the very small size models, wing span of 4 or 8 inches, it is not necessary to add thread for wire effect.

After the model has been completely assembled, it should be given two or three coats of thick dope. Sand well after applying each coat. The color scheme is yellow for the wings and tail with a dark yellow or orange for the body. All struts are black and the front of the body that represents the radiator should be aluminum.

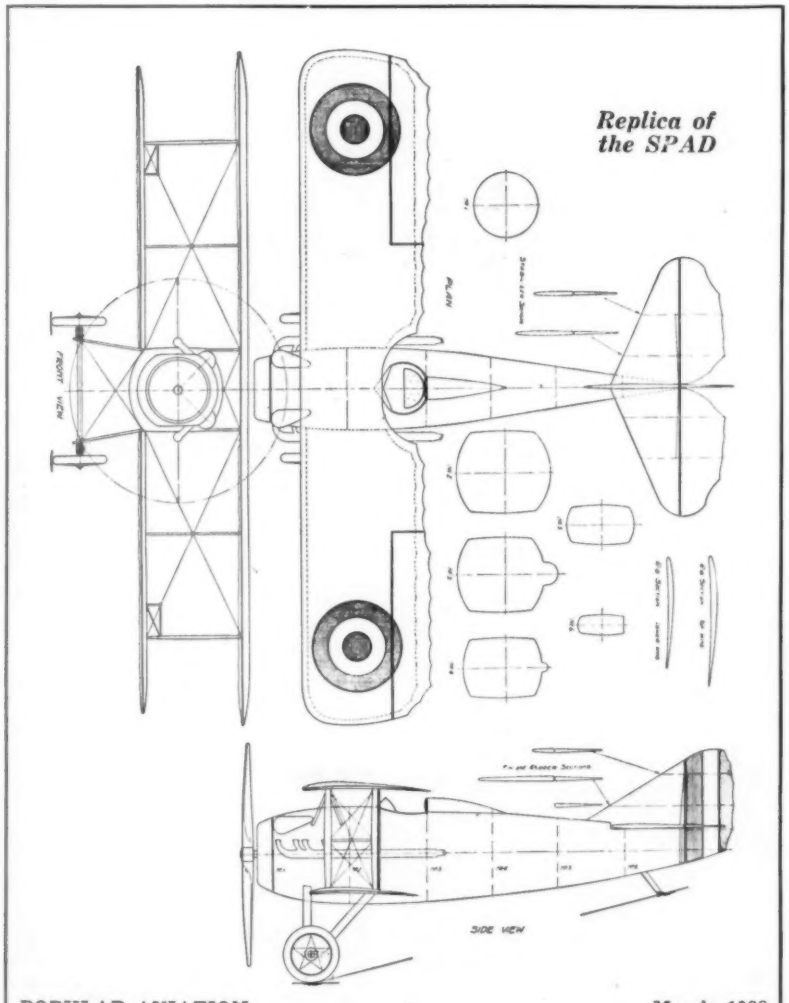
The radiator, after being painted aluminum should be criss-crossed to resemble a honey comb radiator. The exhaust pipes are also painted aluminum. The circles on the wing tips are blue in the center, white and then red on the outside. On the under side of the lower wing this same emblem is shown. The rudder is striped blue, white and red on both sides. The propeller on the large machine was built and carved from wood and therefore would call for a mahogany or walnut finish.

MATERIALS NECESSARY

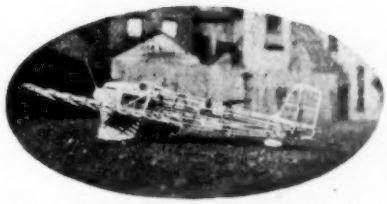
The sizes given are for the eight-inch model and should be multiplied one and one-half times for the 12-inch model.

Body	1 x 1 x 5"	1
Wings	3/32 x 1½ x 8"	2
Stabilizer	1/16 x 1½ x 3½"	1
Fin-rudder	1/16 x 1½ x 2"	1
Struts	1/16 x 1/8 x 12"	1
Wheels	⅝" diameter	2
Propeller	2¼" diameter	2
Windshield	½ x 1"	1
Cement	clear	1
Dope	clear	1
Decorations	Optional	
	Lacquer Yellow	
	Lacquer Black	
	Lacquer Orange	
	Lacquer Aluminum	
	Insignas French	

The replica model to be described in our next month's issue will be Baron Von Richthofen's Fokker Triplane.



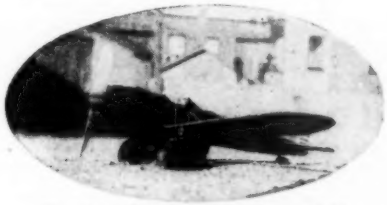
Pritchard Builds an A-8



This is the assembled frame of the A-8 attack plane.

RALPH PRITCHARD, Mount Morris, N. Y., is another old friend of this department. He submits two photos of a Curtiss A-8 Attack plane which is getting right down to date.

The photos show this little ship before and after covering, the uncovered view showing unusual care in the constructional details. All the wood parts of the model are lacquered.



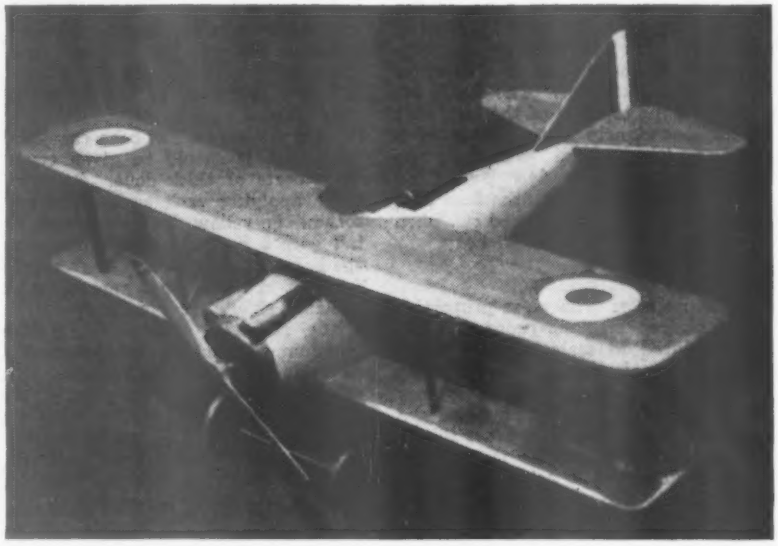
The A-8 covered and ready for flight.

Ralph Pritchard is the president of the Genesee Valley Model Club, and many of our readers will remember various contributions by him to the "Airy Chat."

He writes us that he has made a 100 percent. improvement in the workmanship of his models during the past year, and this must certainly be a real improvement judging from previous models built by him.

Building the Sparrow Hawk

A FAITHFUL model of the interesting and beautiful little comrade of the "Akron." This little ship hooks on the dirigible while in flight and is then stored away in the hull.



The completed Curtiss Sparrow Hawk F9C-2 ready for flight. This is a most realistic model and true to life.

THE Sparrow Hawk is also known as the Curtiss F9C-2 and "Akron Fighter." This plane is the one that is carried within the body of the U. S. Navy Airship, Akron.

As can be seen from the drawing, a special hook is built on top of the upper wing, directly over the center of gravity, with which the pilot can release or attach himself to the airship at will. This may be a ticklish job and no doubt becomes very exciting at times; nevertheless, it has been developed as a practical means.

The overall dimensions of the large machine are as follows: the wing span is 25 feet, 6 inches and the body length 19 feet, 5 inches with a propeller having an 8 foot, 6 inch diameter. The pilot's seat is to the rear of the top wing and places the pilot in such a position that his visibility is best when looking forward and up. This is especially important as it assists in locating the hook on the mother ship.

There is a slight dihedral in the upper wing but the lower wing is straight. "N" struts are used, one on each side of the fuselage, with double flying and landing wires. The landing gear struts are single beams with an open type of wheel boot now becoming popular. An additional brace extends from the lower part of the strut to the upper wing attaching directly to the brace of the "sky hook." Another brace runs from the lower end of the landing gear strut to the opposite underside of the fuselage.

MODEL BODY CONSTRUCTION

THE first step is to prepare a full size layout to the scale given in the drawing on the opposite page. Prepare a drawing of the side of the fuselage first. Do not go into detail but simply draw single lines being careful to keep everything within scale and accurately to the design as shown.

The balsa longerons should be placed directly upon the drawing, held in place by pins, then the uprights and cross-braces should be cemented in position. Build two sides exactly alike, both having the same uprights and cross braces. These two body sides are then cemented together with horizontal braces, meeting the upright fuselage members. After these parts are assembled the body will look as shown in photograph No. 1.

The second step of the fuselage construction is to add the formers that give the body its oval shape. All the sections are illustrated on the drawing and

(*Continued on page* 186)

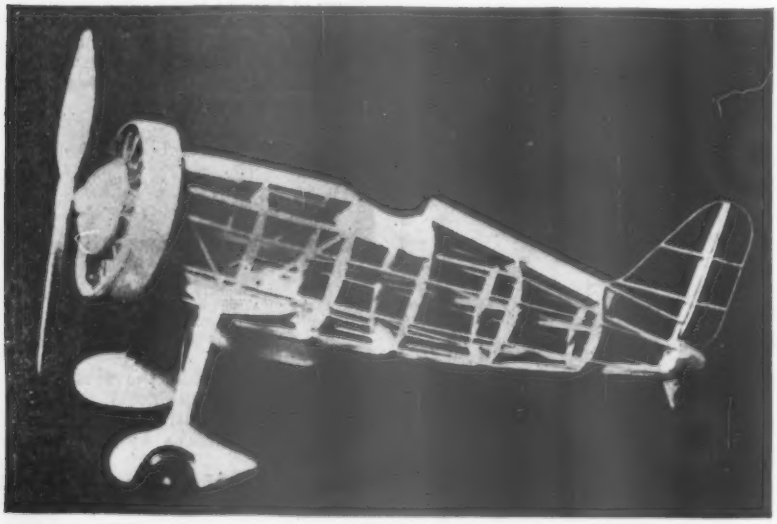


Fig. 3. The completely assembled fuselage. Stringers or long thin fairing strips are laid over the formers, the tail group is added, the landing gear is in place and the prop is mounted.

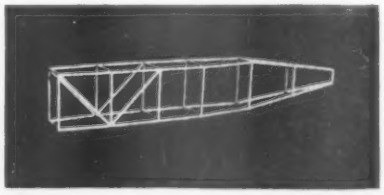


Fig. 1. Fuselage frame assembled with longerons and longeron struts in place. This is the backbone of the model and must be sturdy and well built.

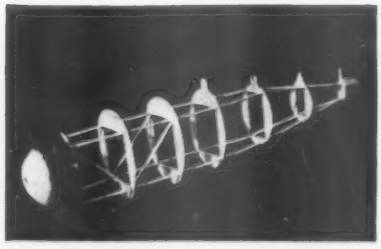
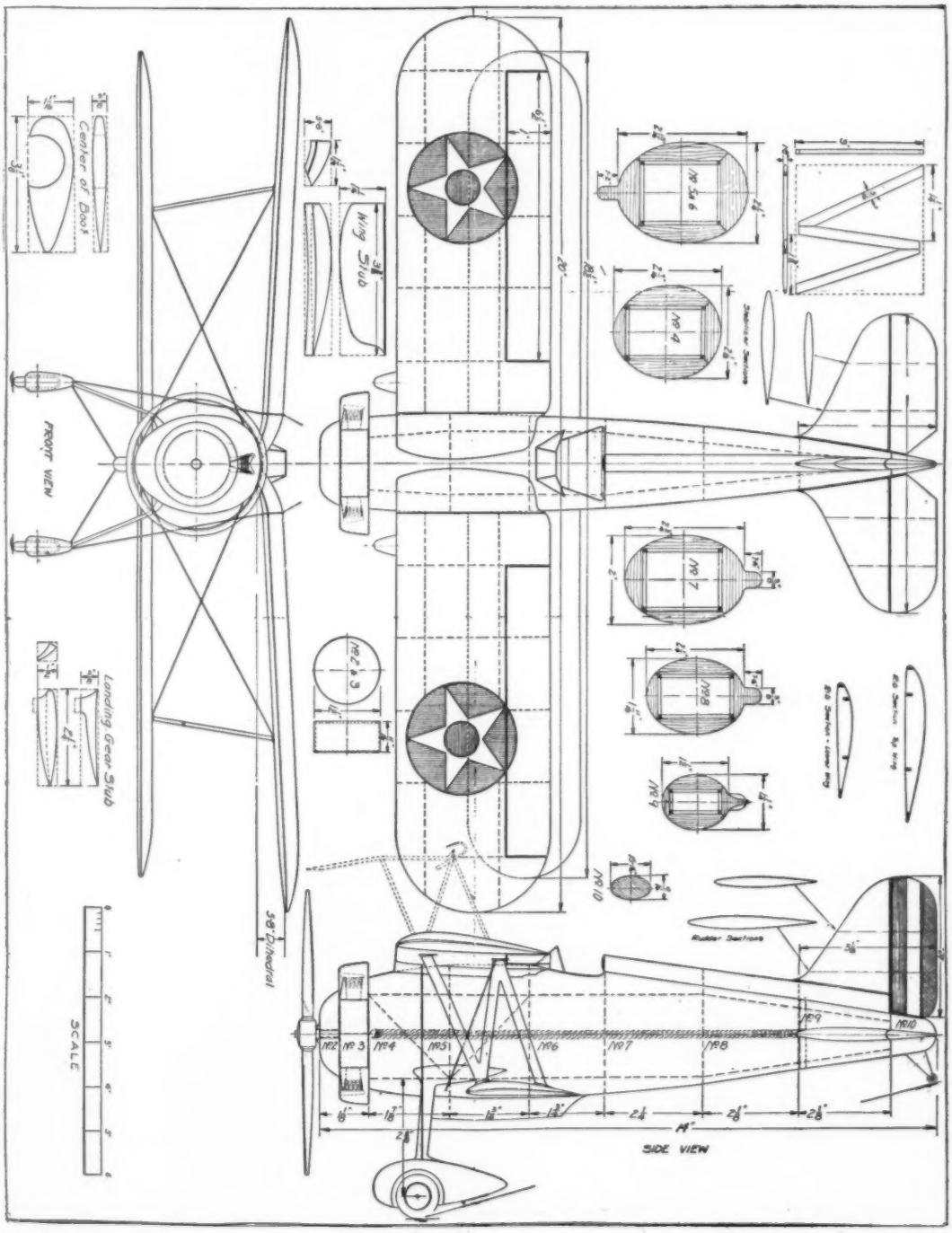


Fig. 2. The Formers have now been added to the fuselage, together with the engine, nose and tail supports. The formers give the required section to the fuselage.

Curtiss Sparrow Hawk—F9C-2

A Flying Scale Model

This midget biplane, also known as the "Akron Fighter" can be made even more realistic by adding two hooks at the center of the top wing as indicated in the front and side views.



Sparrow Hawk

(*Continued from page* 184)

these should be copied as closely as possible. Wherever the construction demands a slight change, or the builder sees fit to make little additions, it is advisable that he do so.

In many cases it will seem difficult to follow all instructions precisely as described and for that reason the model builder should use his own judgment whenever he deems it advisable.

After the formers have been added to the square body, including the tail part, the celluloid motor and the nose, it should appear as illustrated in photograph No. 2.

The next step in the body construction is illustrated in the photograph No. 3 which shows the rudder in place, the tail wheel in place, the landing gear complete, the propeller in position also the cockpit and the auxiliary gas tank on the under side of the fuselage.

To help strengthen the landing gear, the wires used between the upright struts are reproduced in bamboo on the model. This bamboo helps to keep the landing gear in position and braces both ways, either when being pushed or pulled. Note in particular that, where the landing gear stub is attached to the body, a small section which is a thin piece of balsa sheet is cemented to the fuselage from the former directly behind the motor and reaching to the one in front of the cockpit.

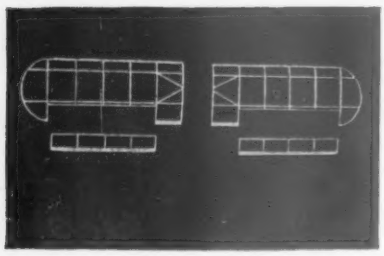


Fig. 4. Details of the upper wing and the ailerons.

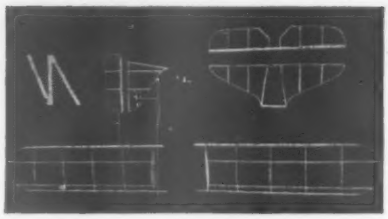


Fig. 5. Lower wings, stabilizer, elevator, fin, rudder and "N" strut.

This balsa sheet should be ⅛ inch wider than the wing stub so that the tissue may be cemented to it. Note also, on photograph No. 3, that this same method is used where the wing stubs are attached to the top of the fuselage. The streamline headrest is made of a thin sheet of balsa sanded down. The wheel is a small washer ⅜ of an inch in diameter attached to a balsa brace which is streamlined and cemented to the solid end piece of the fuselage.

PHOTOGRAPH No. 4 illustrates the upper wing and the aileron. The ribs are all spaced evenly but when building the model to exact scale it will come out a trifle uneven as shown in the drawing. When building it may be more practical to shorten the aileron so that the rib on the outside of the aileron will run to the trailing edge.

A very small thin auxiliary spar is used to give the correct depth to the aileron and also to reach from the underside to the topside of the rib so that no space will be remaining after the tissue is attached. The wing tips shown are bamboo but they may be made of balsa if desired. When making the wing tips from balsa, use a thin sheet about 3/64 inch thick and use three sections to cover the circle.

It is advisable to do this so that the grain will run lengthwise in each section. The joints should meet underneath the spars. This will prevent excessive warping. The lower wings, the stabilizer and elevators, the fin and rudder and the "N" are illustrated in photograph No. 5.

Allow the entering and trailing edges to extend ¾ inch beyond the first rib. The stabilizer outline is entirely of bamboo with the exception of the cross-brace at the front and the rectangular pieces on the inside at the rear. The stabilizer is put through the body in one piece and cemented in place.

The elevators are cut in two. The two longest ribs in the stabilizer are placed a little further out so that when this unit is put in position on the body it will cause the paper to be attached a small distance from the body.

The result is that this small distance which must be covered by the tissue paper, will give the effect of having the stabilizer flared into the body. The fin and rudder construction is very simple and note in particular that the height of the fin is less than that of the rudder as it must be attached on top of the streamlined headrest fairing.

The "N" strut is built of three

(*Concluded on page* 188)

Materials Required for the Sparrow Hawk Model

Spars	1/16 x 3/32 x 18"	4
Leading Edge	3/32 x 3/32 x 18"	2
Trailing Edge	1/16 x 1/8 x 18"	2
Longerons	1/16 x 1/16 x 18"	8
Rib Stock	3/64 x 2" x 18"	1
Former Stock	3/64 x 2" x 18"	1
Propeller	8" diameter	1
Motor Cowl	Left overs from rib stock	—
Nose bearing	Hard wood	1
Boots	3/8 x 1¼ x 3"	2
Gear struts	1/8 x 1/2 x 3"	2
Wing tips	Bamboo	2
Tail outline	Bamboo	2
Windshield	1 x 3"	1
Motor	30 gauge rubber—5 feet	1
Wheels	1" diameter	2
Washers	1/8" O. D.	3
Shaft	.024" diameter	1
Tissue	20 x 24" (White & Orange)	2
Cement	Clear	1
Dope	Clear	1

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24" Span. Weight 1½ oz.
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BOEING XP 936

17" Span, Weight 1 oz. Set contains all materials, turned balsa cowl, aluminum wheels, pants, insignia, drawing, dope, glue. Color, green and yellow.
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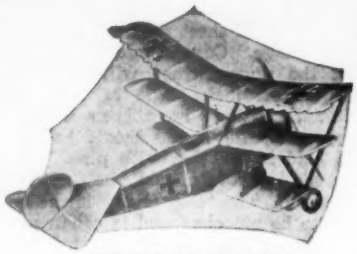
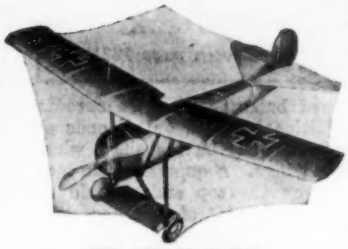


THE FOKKER TRIPLANE
12-in. Span



THE FOKKER D-VIII
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Here's Big Hot News from Ideal!

This is the most sensational announcement we have made in years! Read every word below and find out all about the greatest development in Model Airplanes ever put out. Nothing like these New "Ideal-O-Plane" Kits has ever been offered before at this low price for real IDEAL Quality Kits. Be the first to get them.

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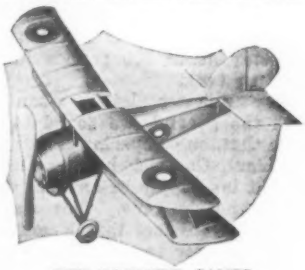
(SEE COUPON BELOW)

FOR months our Engineers have been hard at work designing an entirely new type of Construction Kit, and developing more economical ways to produce these Kits, so you can build realistic Flying Models of your favorite ships at such a low cost that you will want to have half-a-dozen of them; and you can build them for no more than only one would cost up to now.



THE SOPWITH CAMEL
12-in. Span

Now our work is done, and the result is presented to you on this page. Here are six of the most realistic Models you ever saw. Look at the pictures; every one an actual photograph of the exact Model made with these Kits. The Models you build will look every bit as good as these! These are Flying Scale Models with full fuselage bodies, cambered wings, shock-proof landing gear, carved balsa propellers and other features of higher priced Models. Every one is an accurate reproduction of the original, with plenty of detail designed into the Model so you can copy it exactly and easily. We don't need to tell you these six Models are among the most popular with Model Builders everywhere!

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12-in. Span

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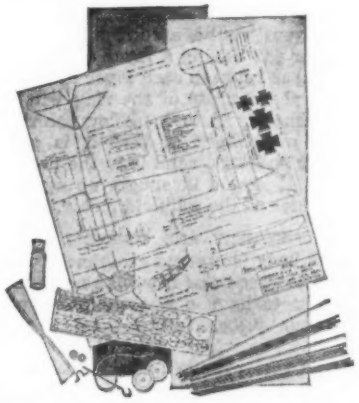

Here's What You Get!

Compare These Kits with Any Others Costing Two or Three Times as Much.

The complete Kit for the Fokker D-VIII is shown above. First, you have the Plan; a big sheet, 12½ x 13½ in., printed on heavy paper and showing full-size views of top, front and side elevations, with every piece and part shown in clear detail and plainly marked, with smaller views of all the intricate details and full instructions covering all operations. This Plan also gives illustrated instructions for finishing the propeller, and the required insignia markings are printed right on the sheet ready to be cut out and attached. You cannot possibly go wrong with a Plan like this to work from!

The wing ribs, fuselage formers, wing tips, bulkheads, landing gear struts and other parts are printed on a sheet of strong, 1/32 in., straight-grained Balsa. Two big sheets of colored Jap tissue are included for covering wings, fuselage and tail, giving the Model the two-colored appearance of the original. Other materials are as follows: 12 Balsa Strips, accurately cut to 1/16 x 1/16 in., for spars, longerons and other parts. 3 Bamboo Strips ready cut to 1/64 in. size for axles and strut and rudder re-enforcing.

Don't Forget to ask for the Ideal Catalog

containing all information about IDEAL Model Airplanes and listing low prices for thousands of items needed by every Model Builder no matter what type of Model you are building. See coupon.

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1 length of ⅛ in. Rubber for motor, 1 Bottle Cement, 2 Hardwood Wheels, ¾ in. size. 1 Wire Propeller Shaft. 2 Brass Washers for same. 1 Wire Rear Rubber Hook. 1 Machine-cut Balsa Propeller, ready for sanding and finishing. Every one of these Kits is just as complete as this one, and every one contains materials of standard IDEAL finest quality. Compare the contents with others which cost two or three times as much money. Did you ever hear of such wonderful value in a Construction Kit for only 25 cents (see coupon).

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We cannot, however, accept orders for less than two (2) Kits because the packing and postage charges are too much. So send your order for two or more Kits at one time. Then the price is 25 cents straight for each Kit and we will prepay the postage charges and deliver to your address fully prepaid. That's only fair, isn't it? Come on boys, let's see what fine Models you can make with these new Kits. Send the coupon below and get into action at once.

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Enclosed find $.....(No Stamps, please; Cash in Registered Letter, Money Order or Check) for which please send me the items checked below:

.....Boeing Fighter Kit	.....Sopwith Camel Kit
.....Polish Fighter Kit	.....Fokker TriPlane Kit
.....Fokker D-VIII Kit	.....Puss Moth Kit

(Kits are 2 for 50c; 3 for 75c; 4 for $1.00; all 6 for $1.50. We pay all packing and postage charges. No orders accepted for less than two (2) Kits. Check the Kits you want in the list above and mail this coupon at once.)
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ARIEL MODEL PLANES

622 Hegney Place Dept. A New York City

Sparrow Hawk

(*Continued from page* 186)

streamlined balsa pieces. Be sure to allow additional length on all ends so that they will not be too short when fitting the wings. A quarter of an inch additional on the top ends should be sufficient. All control surfaces are attached by using soft wire which is inserted into the control spar and also into the wing spar, fin or stabilizer as required.

PROPELLER—RUBBER MOTOR

THE propeller for this model should be approximately 8 inches with a medium pitch and a fairly wide blade. The completed model with the motor of celluloid, completely assembled and colored, ready for flying, should not weigh over one ounce. Five to six strands of 30 gauge rubber will be necessary for flying. The dummy motor may be of celluloid with half of the rear part cut away to decrease weight.

RING OR MOTOR COWL

THE motor cowl for this model is built of thin balsa and consists of four layers wound around a 3⅛ inch diameter jar having a layer of bamboo fibre paper between each layer of balsa. The total thickness of the ring will be approximately ⅛ inch. Allow the ring to dry over night so that it is good and dry and then sand it to the proper shape. It should fit snugly up against the outside of the celluloid motor.

ASSEMBLY AND COVERING

THE body is covered completely with white tissue and it will be necessary in order to have a smooth job to use numerous pieces fitting them as required. The wings and tail units are covered with orange tissue. The lower wing is attached first and should be given an angle of incidence of ⅛th of an inch. After covering the top wings they are cemented to the wing stubs and then cemented in position on the piece of balsa sheet on the top side of the fuselage. Care should be taken so that the upper wings will also have ⅛th of an inch angle of incidence. After the wings have been attached temporarily the struts should be fitted and held in position with pins. Then all the parts should be securely cemented. The "Sky Hook" is the last part to be attached and is constructed entirely of bamboo. Red, white and blue stripes are used on the rudder. For the wings, use the standard 3 inch diameter American insignia.

Our next scale flying model which will appear in the April issue will be the latest Boeing P12-F—a high speed biplane army pursuit.

EDITOR'S NOTE—*This model has been designed and built by following the scale of the original drawing supplied by the Curtiss Wright Corporation.*

NEW

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BALSA WOOD STRIPPER

(Patent Applied For)

Boys—you can now cut your own balsa sticks, tees and angles—quickly and accurately, in width from 1/32" to 5/8"—and up to 1/4" in thickness.

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PRICE **75c** Each Postpaid

AERO MODEL BUILDERS' GUILD

234 Halsted Road Elizabeth, N. J.

Photography

(*Continued from page* 168)

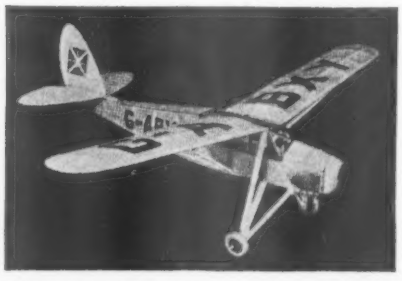
hausted, so when Lieut. Goodrich motioned to me to take more photographs I had to point to the dial which registered only about 300 pounds left in the oxygen tank.

Twenty minutes later, when we reached the ground, we found to our surprise that, on comparing the oxygen tanks, Lieut. Goodrich had used about a third of his supply of oxygen, while mine was nearly gone. This was no doubt due to the fact that I consumed mine at a faster rate because of my moving about, lifting the heavy camera, opening windows, etc.

While in the air I felt a burning sensation in my stomach, due probably to a very light breakfast and no lunch, and I had a severe headache for some hours after landing. We suffered no serious ill effects from the experience, cold as it was, and are well pleased with the results of our first experiment in high altitude photography.

END.

LATEST-WINNER



Another Crescent creation. The PUSS MOTH. This model beat the record of Crescent's Flying Glory which now bows to this masterpiece. BUILD THIS WINNER! Endurance flight 63 seconds. The CRESCENT PUSS MOTH has won high regard in model contests everywhere. ORDER TODAY. PRICE OF complete kit, consisting of GENUINE CRESCENT parts only $1.50 postpaid. Write today. Schools, Dealers, Clubs, see our Flying Demonstrations before ordering. Catalogue 5c.

CRESCENT MODEL AIRCRAFT

1807 Benson Ave., Brooklyn, N. Y.

XUM

Mortician

(*Continued from page 174*)

race or other. It's fun, too, to watch the students flying along in the training ships, struggling to keep the blamed contraptions right side up. Some of them have a hard time, but with real instructors we have here, most always come through with a good grade at the test for their pilot's license.

Soon, after that article about the $70 glider appeared in POPULAR AVIATION, I wrote another about my experiences in a glider club we fellows organized here and that article came out a couple of months after the first one. I was secretary and treasurer of the club and it sure was one grand task trying to keep the books straight with eighteen fellows tearing around like mad most of the time. We built our own glider and flew it from the local field. Don't think we didn't have some fun. Glider clubs are all right and are a sure-fire way to get into aviation with very little expense to the members.

At times, now, I am so busy playing and working at the Funeral Home that I can't find time to give a great deal of actual time to aviation—during such periods I grab up POPULAR AVIATION and spend my leisure moments in perusing its contents—it's a great help.

Well, perhaps this line of hooey isn't very interesting but anyway it's a great world when undertakers resort to playing in jazz bands and flying gliders and airplanes for a pastime. Some day, when I own an establishment of my own, I'm going to have a Stinson-Detroiter hearse, a Ryan family plane and a few Monocoupes for friends and relatives. That ought to be the latest in funeral service. Anyway the family can travel part of the way to heaven with their departed loved one. Hot stuff, eh what?

END.

Q & A

(*Continued from page 167*)

Answer:—THE performance of a surface depends upon its size to a marked extent. Thus, the small wing section tested in a small wind-tunnel will not give the same performance as a larger wing of exactly the same shape. The ratio between the large wing and the smaller wing is expressed by a figure called the "scale factor" or "size factor."

* * *

QUESTION:—G. S. A., Galesburg, Ill. *Is banana oil obtained from the banana?*

Answer:—NO. It is a compound known as amyl acetate, made from alcohol, and is given this name because it has the odor of bananas.

* * *

QUESTION:—H. A. S., Montpelier, Vt. *Give a simple method of getting kilometers per hour in terms of miles per hour.*

Answer:—A KILOMETER is very closely equal to 0.6 mile. Thus, a speed of 150 k. p. h. is equal to: 0.6 x 150 = 90 m. p. h.

* * *

QUESTION:—J. K. B., Racine, Wis. *Can airplane models be made from any other wood than balsa? Can pine be used?*

Answer:—YES, balsa is not the only wood but models made from balsa are lightest and require the least power. Spruce or Douglas fir were used with good results many years ago, and while they call for more rubber, yet they are stronger than balsa and withstand rough usage better.

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—and this is just one of the interesting features!

Boy! The April issue of POPULAR AVIATION will be a double-banked 14-cylinder Whirlwind of interesting and novel articles and announcements. There'll be the Picture Contest for our Photo Phans and others, the announcement of the winners in the big model contest, together with pictures of the winning models, there'll be more dope on the Lightplane Association, and—

There will be some excellent articles on all phases of aviation—stories both long and short, and many excellent illustrations. We did all we could to make this a rousing number—and we have succeeded.

We forgot to mention the big full page photograph of a modern airplane—we'll withhold the name at present—that will appear on the inside front cover of the April P. A. This is what you have been clamoring for and now you're gonna get it. Some issue, we should say.

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Aerial Mapping

(*Continued from page* 156)

horrified crowd that lined both banks.

The little ship dodged power lines, telephone cables and came very near chewing up the Whirlpool Scenic Railway cable-car. Finally they struggled out down by Brock's monument. It was a little exciting for a minute, Bonnick said, but you should have seen the pictures!

He is always getting into something like that. It fell to his lot once to ride in a small two-seater to an out-of-the-way mine up in the mountain country in Mexico. The plane was feeling its way over the unmapped wilderness to the foothills, from where it was supposed to follow the course of a river. Unfortunately, this pilot picked the wrong fork of the river and found himself hemmed in by a rising wall of mountain that pressed him hard on all sides. He saw the snowy summits eighteen thousand feet up, which was more altitude than this plane could get.

THEY dodged around and through the valleys and ravines looking for a way out, but could find none. They climbed, but the mountain climbed as fast as they did. Then they were in a blind alley with a flat face of cliff ahead—no room to turn and no chance of a landing.

Quick! What did they do? Well, what would you have done in a case like that? You'd better hand Grandma the smelling salts before you read her this.

Bonnick is an ex-war flier and so, luckily, was this pilot. There was an exchange of signals and they buckled their belts tight. Then up went the nose into an Immelmann, which is half a loop and half a roll, if you get what I mean. They got up on their backs and then half-rolled rightside up, whereupon they found themselves rightside up and headed out of there with no bones broken.

Just a few months ago he was flying with a youth named E. P. Jeppeson, aged 23. Bonnick was sitting on a bench at the rear of the plane's cabin, reading, when he reached nonchalantly for a cigarette. He fished out the cigarette, and a match, and was just about to light the match when—

Down through the skylight came a veritable flood of gasoline. It splashed all over him; ran up his sleeves and down his neck and soaked the cigarette as well as all his clothing. This was too much for even a placid disposition like Bonnick's. With the match still gripped between his thumb and finger he splashed up the aisle and poked the youthful pilot in the neck for attention. Jeppesen took one look at him and turned green.

IT WAS explained that the ship had been in a whooping power dive at the time and that the center wing tank was brimming full of gas. The force

of the dive had squeezed some of this fuel out of the vent line and along the roof of the cabin.

"But it's just as well I didn't light the dog-gone match," he says.

You would think that a man like this would have all the ear-marks of the typical rough-and-ready adventurer. You look for a massive six-footer, broad of beam and pugnacious of jowl, rumbling out commands in a basso-profundo. And then along comes a little mild man who wouldn't reach to a six-footer's chin, and who wears a bristly Charlie Chaplin mustache and an expression of bored tolerance.

He is a peaceful-looking man with a soft resonant voice who explores the vast unclaimed ends of the earth—a pioneer airman with seventeen years of flying to his credit who is still thrilled to ride in airplanes. He has been bombed, shot at, captured by tropical revolutionists, forced at pistol-point to make pictures for them, lived in makeshift huts in the bleak Labrador Coast and emerged alive from some unbelievable airplane wrecks. And yet he reads adventure fiction and professes to enjoy it.

How can anyone understand a character as contradictory as this? He looks just like any other city man and melts into the mob so deftly that he is soon lost. On the airports he is known only to a very few pilots who have flown him on various expeditions. He is never interviewed, seldom makes a public statement, reports only to those men who direct his long flights.

His influence on contemporary commercial flying is enormous—and invisible. Hundreds of aerial photographers are following the trail that Syd Bonnick opened and hundreds of thousands of dollars annually paid by these men for flying time testify to Bonnick's success in his mission. He is one of the two men who introduced and developed the commercial art of aerial photography after the War, when it was a purely military weapon, and he is the exact opposite of the other one who is Captain Bob Smith.

Every pilot in the country knows Smith, the glad-hander, the salesman, the wizard of trick camera effects, the public standard-bearer for the new profession of making maps from the air. Smith has been in print a dozen times; interviewed, photographed, lauded at banquets, known wherever pilots gather. But Bonnick, his best friend and war-time partner, comes and goes like a Secret-Service man, shunning publicity like the plague.

OF COURSE this phenomenon can be explained largely in the characters of the two men—Smith expansive and friendly, Bonnick engrossed with technical details and a born researcher. It is augmented by the phases of aerial photography each elected to follow. Smith builds a big business out of oblique airviews that anybody can use, and Bonnick makes intricate maps for engineers, explorers and scientists which are too technical to be spectacular and which are full of confidential discoveries that he cannot reveal.

Bonnick is the man who proved to the world that the aerial camera can revolutionize methods of gathering engineering information, because he did it. He changed mapping methods all over the North American continent. He and his camera can fly over mountains, jungles, swamps and forests at better than a hundred miles an hour, doing the work of a whole surveying crew in places where no human being could live. He has pulled back the curtain from many blank spots on the globe, and gazed at regions no human had ever seen before him. He is the greatest expedition aerial photographer in the world, the king of his profession.

He got his start in the R. F. C. in 1915, after a flying course at Farnborough, England. It was while on active duty in France that he began to turn all his attention to photography, and later he came back to England to lecture about it to newly-transferred officers from the other Army branches. In a few months Lieutenant Bonnick became Captain Bonnick and came to Canada to organize photo schools for the Canadian R. F. C.

Shortly after America entered the War in 1917 he had become such an outstanding authority on this subject that Uncle Sam asked Canada to send him to us. He went to the great training fields of Texas to organize his photo schools and direct them.

Then came the cruel awakening. From being an international celebrity and a famous military figure, he found himself just another barnstorming flyer. He went through the whole heart-breaking period from 1919 to 1927. Most of this time he was flying for a firm of topographical engineers in Philadelphia, making strip-maps of projected power lines, dams, factory sites and doing the drudgery of an aerial photographer's job.

Recently he has accepted a commission in Mexico where he believes that his greatest future will be, mapping out those wild and rugged districts that are practically unknown to the white man. Here he will have a wonderful opportunity for still further developing the technical side of his profession amid new scenes and under far more difficult conditions than before.

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Flight Testing

(*Continued from page 146*)

mind began to fog over, and my only thought was to stop the spin.

"I tried to force out of it with power. I juggled the stick, and spun faster and faster. My head was swirling and I didn't know up from down. I couldn't even see the instruments. One more try with power did the trick.

"I jerked the throttle open and straightened out so quickly that it cleared my head, and my troubles were over. Not very exciting to tell, perhaps, but it was the toughest spot I've been in for a long time. And I've never been able to get another P-12 into that kind of spin."

The elaborate system of tests and the standardization of plane assembly have brought the aircraft industry out of the chaotic first growth into a period of stabilization. Revolutionary discoveries that were so frequent until a few years ago, have all been appraised, and the practical theories that are now being utilized in the quantity production of planes.

Starting with nothing more than a vague idea in the engineering department the plans gain momentum through the various departments until the laboratory tests begin on the raw materials, then shop tests on the various assemblies until the final completely fabricated airplane is ready for the strenuous tests just described.

The hazardous business of testing new planes requires a thorough and comprehensive knowledge of all the crazy things a plane is capable of doing, and practical experience in getting out of awkward positions. Only iron nerves will stand the daily test of flying. END.

The Macon

(*Continued from page 146*)

propeller attached to each engine will turn twice to every three turns of the engine.

Tanks for fuel, water and storage are attached in such a manner that they can be dropped to provide greater buoyancy in an emergency.

The sub-cloud car, originally designed in this country by the Air Corps, is an improved model of the original car. The car is supported to the airship by a single cable as far as 1,000 feet below the ship. The car itself will be internally suspended flush with the envelope, its supporting cables dropping from the top of the inside of the gas compartment. Other airships all have the car suspended below the bag with the cables attached to the exterior of the envelope.

The big non-rigid will be used in coastal patrol work by the Army. At 65 miles an hour it will be capable of travelling 1,000 miles; at 50 miles an hour, 1,800 miles; and at 25 miles an hour, 2,500 miles. It may be refueled while in flight.

Operation features of the TC-13 were designed by Captain Axtater of Wright Field, Dayton, who spent 20 months in Akron studying the design and building of the Akron, while that ship was in course of construction. Engineering features were by J. C. Yingling, aeronautical mechanical engineer at Wright Field.

And when this giant dirigible takes to the air next spring, it will be an epoch of monumental importance in the history of lighter-than-air craft.

END.

Training Errors

(*Continued from page 148*)

motors fourth, with sideslips, fire, steep banks, collapse of plane structure and undetermined causes in the order listed. On this subject Major General Mason M. Patrick, Chief of Air Service, A. E. F. writes:

On November 11, 1918, a total of 218 pilots and observers had been killed at training centers; 169 were students undergoing instructions and 49 were instructors, testers and transfer pilots. Of these accidents 19 deaths were due to collision in the air, and of the rest, a great many can fairly be ascribed to engine failure and lack of judgment or poor flying on the part of the pilot. The balance must be put down to "causes unknown". Classification into the particular maneuver which the machine was performing at the time of the crash, such as "stall", "vrille", "sideslip", "dive", etc., is not very helpful, since these effects have probably in all cases resulted from the fundamental failure to maintain sufficient flying speed.

Examination of the figures, however, shows that the number of fatalities increases rapidly with the use of small fast machines. Thus, with the Avro or similar type of preliminary training airplanes, only one death for 3,000 and 4,000 hours need be anticipated, while experience has pointed out the greatly increased risk of training on such machines as the Sopwith Camel, Dolphin, and Spad. Of course, the fact that these machines are, as a rule, used for the more advanced and dangerous work such as combat, gunnery, and acrobatics, has an important bearing on any comparative figures.

In the schools of the American Expeditionary Forces the hours flown per fatality vary from 2,738 for preliminary training to 1,023 for advanced and pursuit training. The general average is 1,173 hours per fatality. It seems a safe conclusion that approximately 1 fatality per 1,000 hours is to be expected in advanced training under war conditions. The proportion of fatalities to graduation in the American Expeditionary Forces shows 1 fatality

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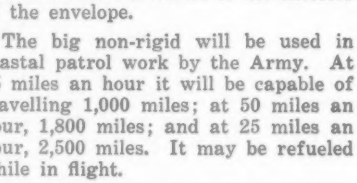

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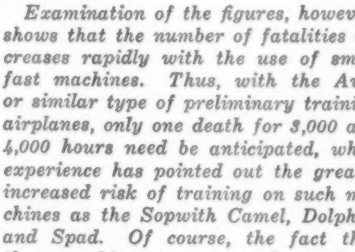

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to 90 graduates in preliminary work, 1 fatality to 9.2 graduations in pursuit training, and an average of about 1 fatality to 50 graduations in observation and bombardment. The total average appears to be 1 fatality for every 18 completely trained flying officers available for service.

These are the dreary statistics of the death-dealing training planes—and the venturesome, reckless cadets, who flew them.

It will be seen that in most cases, with the exception of conked motors and structural weakness of ships, the human element was directly responsible. Which in other words means lack of experience in proper handling of a ship. It is known England's motors were notoriously unreliable. But the report cadets were forced to fly worn out crates does not stand up. The "unknown" cadet ranks are next to last on the list of causes of accidents in his diary.

THIS book I found to be a most absorbing document. Pertinent and unquestionably authentic. No one could possibly have written it without having witnessed most of the crack ups, or obtained firsthand information from his fellow cadets. Its humorous remarks bolt at me unexpectedly right on the heels of several grim tragedies and I review it now.

Without bothering to give the full name of the cadet, the "unknown" aviator tells of the detachment's first loss, Cadet Ainsworth. It relates briefly of the disaster and humorous results of accidents experienced by other cadets on their first solo flights. Faithfully it follows the members of America's most famous training detachment from Thetford to Samford and London Colny, up to Ayr, Scotland, where they received machine gun training and were taught aerial gunnery. There most of the cadets lost their lives when compelled to put the fast, tricky Camels into the deadly right spins.

Some of the comments appear flip; others cynical. This man, living and flying every day with death, forgot to fear it. He expected death; wondered if he would be the next to "dig his grave with a Gnome motor."

It tells of "Hash" Gile, who was bawled out by an instructor for not getting his tail up in a take-off. And when Gile pushed the stick against the instrument board on a second take-off and held it there, forcing his tail to come up and flop over in front of him, the laconic comment is: "Turned turtle —the dud!"

One of the most heroic attempts to save oneself from disaster is told in this worn book. It tells of Cadet Montgomery riding in a "AK.W." as an observer. At the top of a loop his pilot's safety belt broke and he was thrown into space. Montgomery, realizing his peril, calmly unfastened his belt.

As the plane careened drunkenly to earth out of control, Montgomery clung to the fuselage in a desperate effort to crawl forward and get into the pilot's place. Just as he had his hand on the stick the ship plunged him to his death. The diary briefly and flippantly records this outstanding act of cool headed courage—"pilot fell out of seat in a loop; observer game, but angel now".

There are numerous accounts of pilots whose accidents ended in wild laughter of those that witnessed the sorry plight of the cadet. A funny one relates how Pansy strafed a roof top and "forced down out of control a chimney". It was a write-off for his plane. But "Dud" Mudge surpassed that one by going through the side of a hangar. Mudge did a swan dive out of the nacelle and scared a mechanic half out of his wits. The motor was full on and the pull of the prop pulled the wall in, causing the roof to tumble in after it.

BUT the prize one that gave the boys many a hearty laugh is that flight of Tracy Bird. I mean the time he crashed through the roof of a house where two old maids had moved from London to be safe from air raids. Bird considered it his narrow escape as the women, although startled by his sudden and unconventional entrance, were none the less pleased with his unexpected and surprising visit and welcomed him warmly.

Another act of outstanding gallantry is that of Cadet Wheelock.

Flying with Cadet Berry in a Bristol Fighter up at Ayr, the plane crashed and caught fire. Berry was so severely injured he couldn't extract himself from the burning wreckage. Without a moment's hesitation Wheelock, although suffering from a broken arm, made his way into the flames and with considerable difficulty rescued his comrade before anyone on the field could get to the flamer. Both airmen were badly burned. And the diary's list makes the crisp comment: "Two hot birds roasted," short, snappy yet indifferent to death.

But I can best let the Death List speak for itself. Its graphic account, its terseness and its moments of lightness are its grit and its flavor. It plainly indicates that life for a cadet was pretty much a bowl of backwash; and Death was but a jest.

END.

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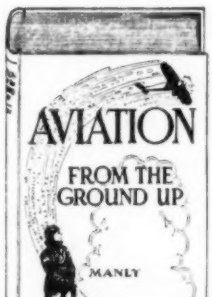

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Lightplanes

(*Continued from page 171*)

surfaces (wings.) If the angle of downwash (wind) coming from wings, is 3° when it reaches the tail, the wind is hitting the horizontal tail surfaces on top. That is why some ships fly with their tails down.

NOW the fuselage may increase the downwash or decrease it according to whether the ship is a high wing or low wing. A bi-plane or a parasol type of ship will increase the angle of downwash approximately 2°, so then the angle of the down wash is about 5° at the tail. You will notice our horizontal tail surfaces are about 5° incidence with respect to the top longerons.

Every wing section has a different angle of downwash. The approximate formula used in the preliminary design is:—

Angle of downwash in degrees =
5.25 C_L + 0.25.

C_L = Absolute lift coefficient

This formula shows that the angle of downwash depends on the coefficient of lift of the wing.

Some "airplane bugs" had trouble with low wing monoplanes. The trouble may have been too weak a wing structure or the wrong angle of incidence in the horizontal tail surfaces. The fuselage in the low wing, affects the angle of downwash, differently than the biplane or parasol monoplane. In the low wing, the angle of downwash is constantly decreased as the angle of climb is increased, until about 12° angle of climb (or attack), then the angle of downwash suddenly is increased as the angle of climb is increased. That all sounds rather treacherous, doesn't it.

Another thing which seems to be neglected, or never mentioned by the manufacturers of light airplanes, is the "wash-in" and "wash-out" of incidence on the wing tips to take care of propeller torque.

Our ship has adjustable rear wing struts so that incidence of the wing tips can be adjusted.

Most American aircraft engines turn clock-wise when viewed from the cock-pit, if a tractor type airplane. Foreign engines turn anti-clockwise also the Henderson motorcycle conversion.

The Continental A-40 engine turns clockwise, which we used in this ship. There is a tendency for the engine to turn in the opposite direction to the propeller, and being that the engine is attached to the airplane, the whole airplane tries to turn over with the engine, in the opposite direction to the propeller. That is why the ship will try to fly with the left wing low.

To correct this we must use ailerons to bring that wing up, or put more incidence in the left wing tip and less incidence in the right wing tip.

FOR this engine and this wing, we first rigged the wings to 0° incidence in level flying position, then by use of the rear adjustable flying struts, we lowered the rear spar of the left wing one-quarter (¼ in.) inch, and raised the rear spar on the right wing one-quarter inch at the strut connections, which are about 6 feet from the wing tip. This puts a slight twist in the wing. This warping the wings is spoken of as "wash-in" and "wash-out."

The wing section we used was originally a German section, used on gliders. We changed the leading edge to more like an American section and found that it would glide further. Then we made the section thicker at the rear spar so we could have a strong spar for airplane use. The section now resembles an American section, called the U. S. A. 40.

The center of pressure of this section, at 0° angle of attack, is 45% of the chord from the leading edge of the wing. We placed this point in the wing above the place in the fuselage where the center of gravity was located. The usual practice is to figure, mathematically, the location of the C. G., of the complete loaded ship, but some amateurs seem to prefer building the ship and balancing it over a wood horse. This works, but sometimes the old C. G. pops up where you don't want it, due to something weighing more than you expected.

After the wings are placed properly, the landing gear should be placed so that the wheels make contact with the ground at a point 15° in advance of the C. G. with the ship in level flying position. That is, if a line were dropped from the C. G. position, to the ground, and another drawn from C. G. to the point of the wheel contact, the angle formed by these two lines would be 15°.

The ribs are made in the strongest manner known, that is, the Warren type trussing, with no nails to split the spruce or punch holes, thereby weakening the rib. The rib is exactly as the U. S. Army test laboratories consider best. Many amateurs neglect the strength of the rib at the point of connection to the spar. Here is where most failures occur. There must be a firm connection to the spar, and the rib should be strong at this point.

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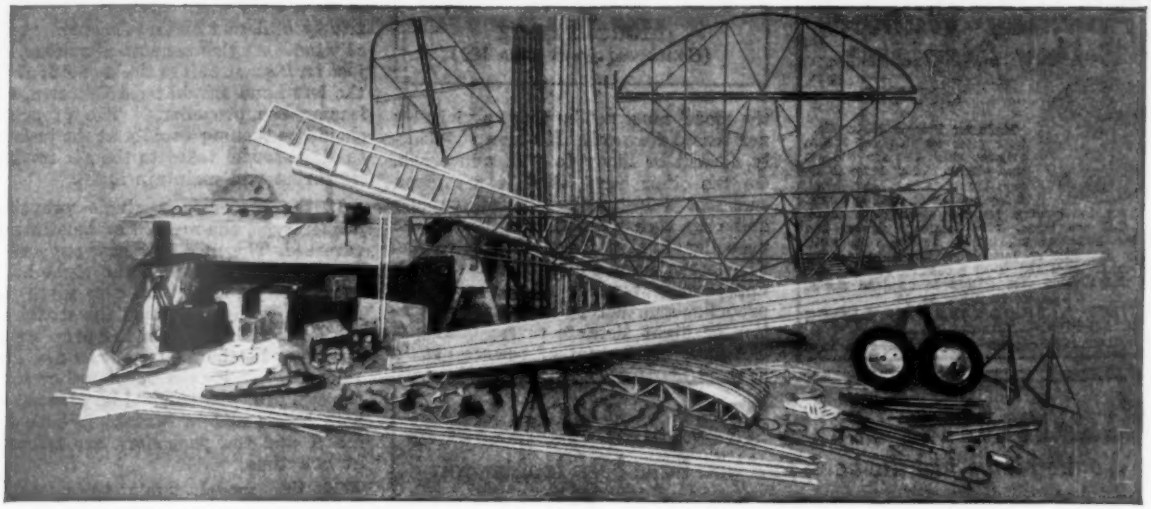

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Model Flying

(*Continued from page* 180)

the model must not be thrown violently nor tossed forward. If thrown violently, it will be likely to stall and crash. On the other hand, if it is not given sufficient velocity it will fall rapidly and may strike the ground before the propeller finally comes to the rescue. The latter error causes the loss of an unnecessary number of turns of the propeller and thereby reduces the duration or flight distance correspondingly.

Again, the instant of release should be at a time when the air is comparatively still and always between gusts of wind. At the moment of release, or just an instant before the model is free, the left hand should be withdrawn, releasing the propeller. The propeller should be turning rapidly at the instant that the model takes to the air so that its thrust will maintain flight.

If the model is a single propeller pusher type, the method of handling is reversed. The model is now supported by the left hand while the right hand grips the propeller and also gives the forward push that sends the model on in flight. In this case, the prop starts revolving the instant that the model is released. If it is a twin pusher then the two propellers should be grasped by both hands and in launching, both the model and the propellers are released at one time.

If the model tends to nose-dive sharply, move the wing forward. If it stalls and drops-tail down or flat, move the wing toward the rear. If it is not possible to move the wing, correct the nose-dive by a small weight on the tail, or correct the stall by a small weight on the nose or hung from the landing gear.

If the model climbs too steeply or stalls on the climb, the model is tail-heavy and should be corrected as already noted. If the model does not climb readily it is nose-heavy. In this case we have assumed that the model does not side-slip with one wing low.

Side slipping or a tendency toward turning over in the air is usually caused by motor "torque", that is, by the turning effort of the motor which tends to turn the model in the opposite direction of the propeller. This can be corrected by warping or turning down the rear edge of the low wing slightly so as to give more lift on the low side and thus resist the torque.

The wings should be parallel to the tail in all cases, while the vertical rudder must stand parallel to the fuselage centerline for straight flight. For making turns, the vertical rudder can be bent slightly to one side or the other.

It is safest to try the first flight on a large unobstructed vacant lot or field with short grass. Trees and buildings cause gusts and air-eddies that may interfere with the flight. A building may cause a down draft when the wind comes over the building that makes flying impossible, for the down draft will invariably drive the model to earth as soon as it is launched.

A perfectly calm day is the safest for the beginner, while a gentle steady breeze comes next in order. Gusty weather, with the wind coming in sudden puffs is bad for model flying, even though the gusts are not strong.

Bending the wings up at the tips to form the so called "dihedral angle" will improve the stability or steadiness of flight but it will reduce the speed and duration of the flight.

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German Amphibian

(*Continued from page* 160)

dural spars and simple ribs. Like the wing, the leading edge is covered with sheet dural riveted in place with external hollow rivets.

The fin is fixed to the hull by four bolts while the stabilizer, which has its angle of incidence adjustable by a spindle at its front spar, is supported by the fin and braced to the hull by a steel "V" strut on each side. Fabric is attached in a manner similar to the wings except that the struts are stamped into the rib flanges.

All control surfaces consist of a tubular dural spar and sheet dural ribs riveted to the tube. Ball bearings are provided to give easy action.

The landing gear is attached to each side of the boat at three points. The two lower points are just above the water-line and the upper one is below the forward wing hinge. The landing gear rotates about the lower two attachment points both for retracting and landing. The compression strut contains an oleo shock-absorber and retracting mechanism all faired into one complete housing.

The retracting mechanism consists of an oil piston fitted with an automatic mechanical stop which locks the wheels either up or down when the end of the travel is reached. The wheels are actuated by a pump in the cockpit and operated with exceptionally little effort by the pilot. Only one hand is needed so that the pilot can actuate the landing gear while flying.

The 425 hp. Wasp engine is installed on a welded chrome-molybdenum steel tube mount attached to the boat hull by four bolts. The engine mount design was laid out with the idea of using either the 425 hp. Wasp or the 525 hp. Hornet engine and thus the Hornet engine can be installed without redesigning any part of the plane.

The propeller clearance is such that a two blade Wasp or three blade Hornet propeller could be used. The rotation plane of the metal propeller is far in front of the pilots and the control system. The engine controls work by means of an Ahrens Control mechanism connected to push rods.

The engine location and the nacelle form are the result of an extensive series of full flight tests with various combinations. The present streamlined cowl and ring is designed so that all parts of the engine are easily and quickly accessible.

In the engine nacelle is the oil tank and an additional fuel tank separated from the engine by a firewall. The gravity gasoline tank is fitted with two drains; the upper drain allows for a limited amount of gasoline to be used for starting the engines without any hand pumping.

In the wings are welded aluminum gasoline tanks of sturdy ribbed construction, fitted with swash plates to prevent any sudden surges of gasoline. The tanks are vented in such a manner that no gasoline is lost regardless of the attitude of the airplane. In the bottom of each tank is a special Heinkel type magnetic gasoline guage visible from the cockpit.

The wing tanks have their lines go directly to a U. S. standard three-way, four-port valve in the nacelle and remotely controlled from the cabin. The valves shutting off each of the wing tanks as well as the hand fuel pump are located in the wings and have remote controls in the cabin. In this way it may be seen that the only gasoline that enters the cabin is that on the small primer pump line.

The three Lorraine Algol motors of 300 rated HP develop about 370 HP apiece, turning the propellers at approximately 1800 r. p. m. Other characteristics are:

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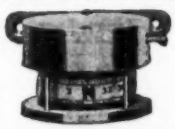

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Cross-Country

(*Continued from page* 166)

up like a house afire. Later on some towns were passed but they were not on this strip map. Finally he recognized the name HAMILTON on the roof of a small way station and followed down into Columbus.

I could go on quoting numerous instances of pilots gone astray, but enough is enough. Suffice to say that it's wise to remember that *you* are never lost, it's always your course that has gone astray and must be found.

Do you pilots know that Army fliers are required to pack along a Rand-McNally map of the United States (1 inch equals 80 miles) on a long cross-country trip, in case they run off the strip map that they use from one landing to another? Do you also know that the Department of Commerce hands out two mighty useful booklets, one the "General Airway Information" and the other the "Description of Airports and Landing Fields in the United States"? They take up very little space and may be the means of saving anything from a reputation to a life—or even a darn good airplane.

And so, with attention to the matters suggested, cross-country flying will be as natural and safe as walking in your own backyard.

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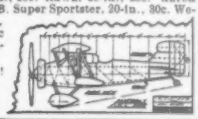
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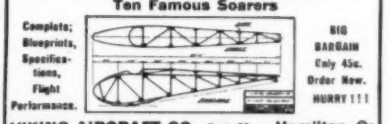

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Airy Chat

(*Continued from page* 142)

I HAVE had a lot of fun looking over the responses to a suggestion of mine made in the January issue. You probably remember that I was becoming rather fed up with the "happy landings" phrase that terminated about 90 per cent of the letters received by me.

Well, as usual, the bunch were agreeable and tuned in with some rather hot closing phrases. Just between you and me, it looks as if many of these letters were written for the express purpose of displaying such terminatives as the following:

"Yours 'till the struts crack."

"May three-pointers always be yours."

"Here's for nuts in your soup."

"May your landings always be with wind on your nose."

"May your visibility always be 100 per cent."

"Yours till the howls become cheers."

"Lighter than air but heavier than lead, I'm going to saw-off and go to bed."

"Many happy returns—all in one piece."

And so on. It rather looks as though I have started something among our humorists.

* * *

IT IS interesting to note that one of our contributers, F. E. Nagle, has just finished working on the reconstruction of Capt. Hawks' ship, the "Mystery S," which is being placed on exhibition in the Smithsonian Institution, Washington, D. C. He promises to send us a story on this job.

* * *

NOTICES work quickly when placed in P. A. Within a week from the time that the February P. A. appeared on the news stands, requests had been made for the return of all of the letters (less one) that appeared in the "Port of Missing Men." This is sure quick action.

* * *

GETTING back to the subject of the model contest, which is ever on my mind these days, I have noticed a most marked peculiarity in the preferences of the model builders.

Out of the deluge of photographs that have poured into this office, literally by the hundreds, there were only eight World War plane models submitted. Among the most prominent were the Gee-Bees, the attack plane A-8 and the Akron Fighter. A surprising number of cabin commercial transport models were also sent in.

And here is the end of this month's chat—see you later. J. B. R.

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OUTLINE OF CONTENTS
(Greatly Condensed)

Introduction: Comparison of bird flight with airplane flight—Ornithopter — Helicopter — Autogiro — Essential parts of airplane.

The Airfoil: Operation of wind tunnel and balance — Airfoil characteristics—Relation between lift coefficient and speed—Creation of lift—Explanation of drag—Characteristics of L/D ratio—Center of pressure travel—Effect of variation of airfoil dimensions—Thick airfoils—Distribution of load along chord of airfoil—Lateral center of pressure—Effect of aspect ratio—Use of taper in planform and thickness—Shape of airfoil tips—From model to airplane—Reynold's number and variable density wind tunnel.

Selection of Airfoils: Data and methods for comparing airfoils—Reasons for varying values of gap/chord ratio and stagger—Decalage—Pressure distribution tests—Mean chord of a combination of airfoils—Downwash.

Parasite Resistance: Struts — Wires—Fittings—Wheels—Fuselage—Landing Gear—Tail surfaces—Radiators, core, plate, wing— Engine drag—Miscellaneous parts—Interference—Determining equivalent flat-plate area—Retractable chassis.

Propeller: Propeller as a group of airfoils—Propeller design procedure—Tests—Three or four-bladed propellers — Selection of propeller design for a given airplane—Controllable and automatic propellers.

The Complete Airplane: Four units of complete airplane — Ground speed, air speed, relative wind, angle of attack—Equilibrium in climb, glide, dive—Determining stabilizer setting—Determining ability of elevators to balance airplane—Model tests—Proper position of thrust line, of center of resistance—Condition of balance required.

Stability: Determining dynamic stability and static longitudinal stability—Effect of position of c.g. with respect to wing chord—Lateral and directional stability — Dynamic stability in flight.

The Control Surface: Differential aileron control — Balanced control surfaces—Frise aileron—Auxiliary methods of lateral control — Formulas for control surface design—Special cases of rudder use.

Performance: Horsepower-required curve for different altitudes—Landing speed—Best gliding angle—Endurance and range—Corrections for speed and scale effects—Other methods of performance prediction — Characteristics of airplane that affect performance—Official tests.

Dynamic Loads: Accelerations occurring as a result of sudden changes in angle of attack. Time history of power-on and power-off pull-ups at 181 m.p.h.; of right and left barrel rolls and a right spin — Inverted flight — Landing and taking off.

Materials and Construction: Features governing design—Use of wood and metals — Retractable landing gear—Single-wheel chassis—Oleo gears—Landing gear—Shock absorbing wheels—Brakes—Tail skid—Skis—Wing, fuselage, tail coverings.

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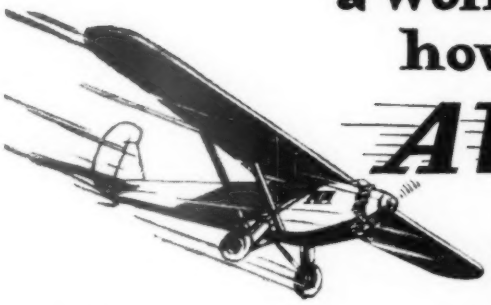

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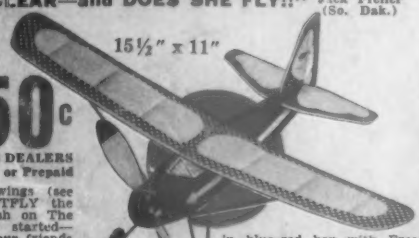

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